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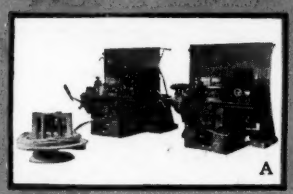
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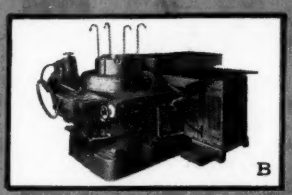
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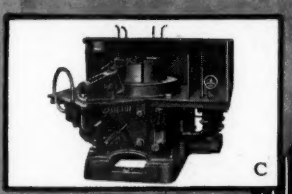
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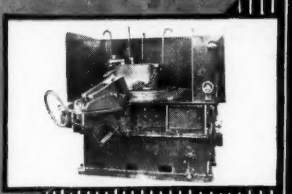

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Illustration "B" shows a No. 13 Motobloc arranged with two die holder brackets for drawing either single or in tandem.

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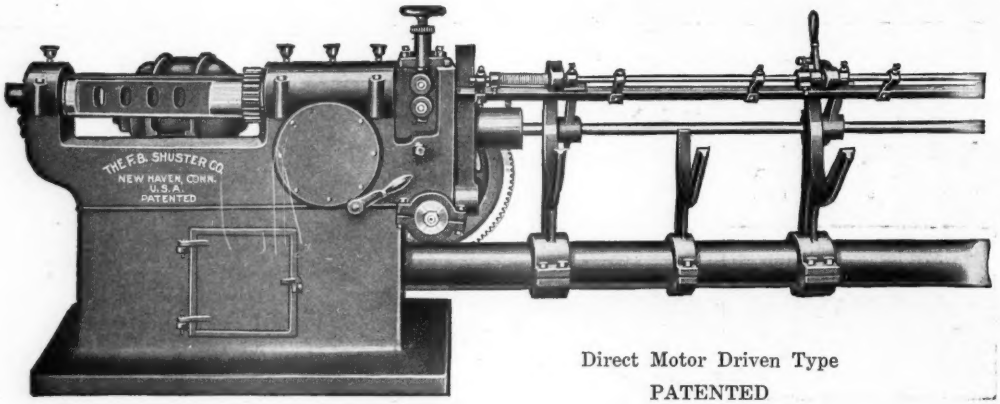

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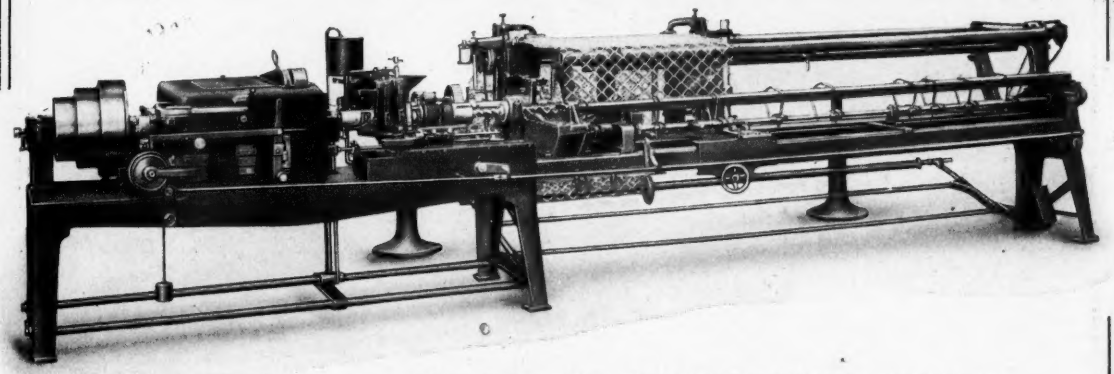

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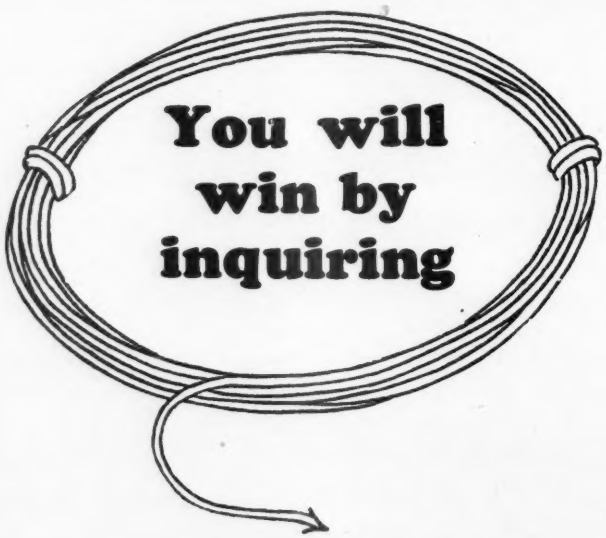

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BOOKS on wire manufacture are scarce. Not infrequently we receive inquiries from our readers concerning literature on certain problems in the drawing, testing or fabrication of wire and wire products. Despite our best efforts to assist our correspondents in these cases our replies are necessarily brief and inadequate. There simply is no extensive literature to recommend.

Wire & Wire Products in its brief career to date has done all a trade journal could to supply this demand for technical information. We have not it is true received the same response in contributions from this country as from abroad, still the discussions published have well represented the best experience of American as well as European wire manufacturing practice.

The Publishers are now planning to collect some of the series of articles appearing in Wire & Wire Products and publishing them in book form. The first of these volumes will probably contain the series of contributions by Dr. Wilhelm Pűngel, which treat of elaborate investigations recently completed by Dr. Pűngel on the mechanical properties of steel wire.

These books will be published on a subscription basis and it is to be hoped our readers will support this effort to establish a reliable reference library for the wire industry.

* * *

Although we expected an enthusiastic reception in England, we must confess our surprise at the rate with which our circulation in England is increasing. In a little more than two months subscriptions in that country rose from a negligible number to almost five hundred!

* * *

A word here may not be amiss concerning the new department in Wire & Wire Products in which statistical data concerning exports and imports of wire and wire manufactures will appear.

The Publishers.

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 2 May, 1927 No. 5

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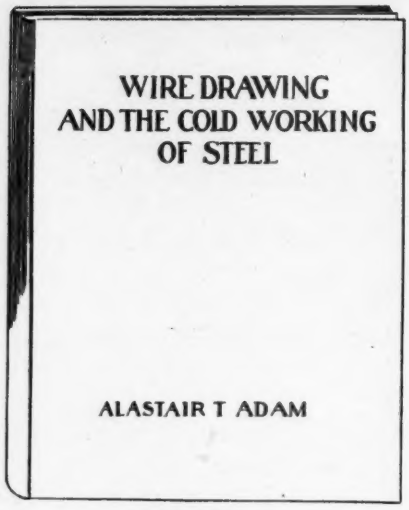

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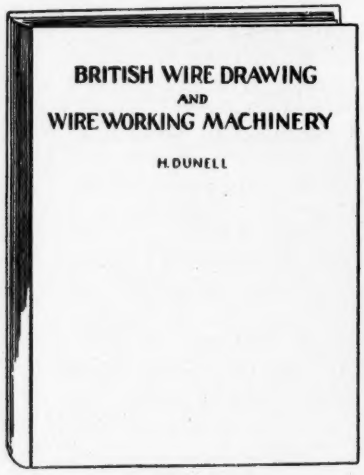

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WIRE & WIRE PRODUCTS

Vol. 2 MAY, 1927 No. 5

Some Investigations on the Properties of Rope Wire

By A. T. Adam

Bruntons Research Laboratories, Musselburgh, Scotland

(Author of *Wire Drawing and the Cold Working of Steel*)

FROM time to time scientific investigators have expressed doubt regarding the alleged improvement in the physical properties of steel by cold working. Is the increase in strength obtained by drawing wire, they ask, of any real advantage or is it obtained merely at the expense of other possibly more important properties? That the high tenacity obtained by drawing is necessary in certain types of wire, such as piano wire, is readily admitted, but when we are concerned with dynamic loading it has been suggested that the increased tenacity is misleading. Particularly to wire for use in running ropes is this argument applied, since such wire is subject to failure by fatigue in bending round pulleys, by torsional stresses and by vibration. Moreover, it is argued that high tensile wire is very liable to fracture when nicked or bruised, as it so often is in a rope which has been in use for some time.

Much truth without doubt lies behind these arguments and it will readily be admitted by wire experts that no good purpose can be served by overdrawing wire. The question arises, however, "What constitutes overdrawing?" The writer's experience on this point is that at a certain stage in the drawing the physical properties of a wire begin to decline seriously, the tenacity still increases beyond this point, but the ductility, as represented by bend, torsion, elongation and contraction tests, begins to drop rather suddenly.

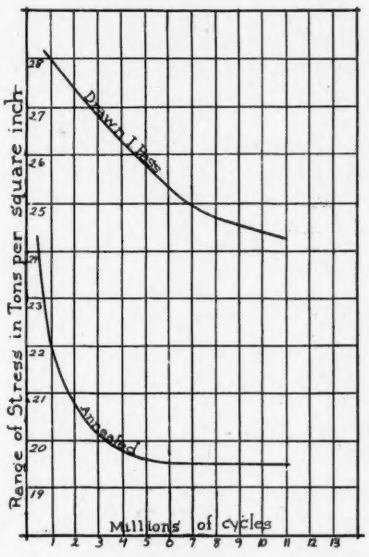


Fig. 1—Endurance curves of ingot iron in annealed and lightly drawn condition. Test made on Haigh Alternating Stress Testing Machine.

Overdrawing

Microscopic analysis of wires affords strong evidence that this sudden failure in ductility occurs when the crystals have been elongated to their full capacity and when further drawing can result only in internal rupture of the already elongated fibres or a weakening of the intercrystalline boundaries.

It is presumably at this stage in drawing, beyond which it is never desirable to go, that the wire reaches its maximum efficiency as regards combined tenacity and ductility. It by no means follows, however, that this is the ideal finishing stage for all wire since it is obvious that any further work put on such a wire in service can have only a weakening effect. For some purposes doubtless, drawing to this stage is permissible, since the wire may not be compelled to absorb any further work in service but this cannot be said of wire used in running ropes.

In a recent paper Dr. Horsburgh concluded: "That rope wire should not be too highly drawn, so that the grains should be still able to adjust themselves

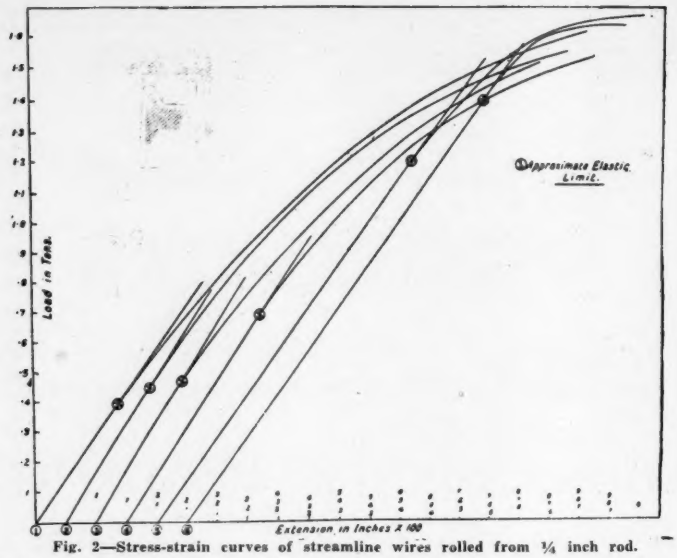


Fig. 2—Stress-strain curves of streamline wires rolled from ¼ inch rod.

infinitessimally under shock and so ensure a longer working life. Roughly speaking, it seems that the material for a steel rope of definite composition and metallic structure is capable of undergoing a certain amount of work. If too much has been accomplished on the individual wires by the draw-plate too little may be left for the useful purpose of the engineer." From this it will be noted that he appears to regard fatigue of the wire as inevitable and considers the power of the wire to absorb work all important. The question, therefore, arises—"Is fatigue inevitable or not?"—and it is just round this very point that the writer considers the main problem of rope wire centres.

Fatigue Limit

The true fatigue limit of a metal is the maximum load repeatedly applied which it will stand for an indefinite period. It varies according as the load alternates from compression to tension or is entirely pulsating. From tests made in Bruntons Research Laboratory on the Haigh Alternating Stress Testing Machine it has been found that cold working, as in wire drawing, does not raise the fatigue limit appreciably. Under alternating tension and compression of equal amount the fatigue limit of patented steel wire ranges from about ± 20 to ± 35 per cent. of the maximum stress according to the composition, heat treatment and amount of cold working, these figures referring, of course, to wires of average quality only, since any abnormality may upset the fatigue limit enormously.

Now this percentage is much lower than can be obtained from steel in the most suitable heat treated condition, particularly in the alloy steels where the fatigue limit ranges from about ± 40 to ± 50 per cent. of the maximum stress. From this it might at first sight be deduced that there is no object in producing high tensile wire for ropes which are subject to fatigue stresses, since a wire with a tenacity of 80 tons per square inch can be made with as high, if not a higher, fatigue limit than one with a tenacity of 120 tons per square inch and in addition with much greater ductility as represented by elongation. This is illustrated by the following figures.

Sample	Diameter Inches	Maximum Stress Tons per sq. in.	Approximate Fatigue Limit Tons per sq. in.	Elongation per cent on 2 in. gauge length
Drawn wire ...	0.091	118	±35	2.95
Heat Treated Wire	0.091	82	±35	12.00

There are, however, other considerations in dealing with rope wire which make it by no means certain that the actual fatigue limit is all important. The life of a rope is limited by wear and corrosion, two very variable factors, and in many cases the period of endurance of the wire under stresses above the fatigue limit is more important than indefinite life below it. The effect of cold work on this factor is, therefore, of great interest and presumably of considerable importance from a practical viewpoint.

In Fig. (1) are shown the endurance curves of ingot iron in the annealed and lightly drawn conditions respectively. From these curves it will be seen that the annealed material has a definite fatigue limit of ± 9.75 tons per square inch, while the drawn material has no definite fatigue limit within the period tested, namely 11 x 10^6 cycles. Up to this period, however, it will stand a load of ± 12 tons per square inch. Thus it will be seen that cold working, though not apparently raising the actual fatigue limit appreciably, increases the endurance under stresses beyond the fatigue limit, a point which seems

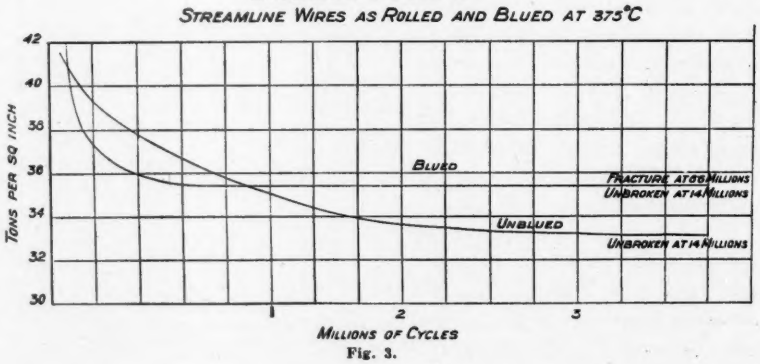


Fig. 3.

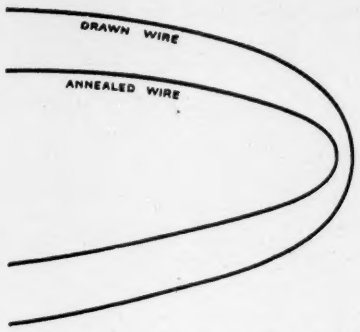


Fig. 4—The permanent set of wires, resulting from a single bend. Note the greater localization of deformation in the annealed wire.

to the writer of great importance in rope wire. True, the above figure shows this in an extreme degree, the wire in question being practically pure iron, but even plough steel wire is affected in this way by cold working although to a less extent. The above curves seem to offer an explanation of the preference for mild steel wire in elevator ropes. The wire in such ropes may be stressed slightly above the fatigue limit but the time required to cause failure is much greater than the normal life of the rope.

The following explanation of this phenomenon was suggested to the writer in the first place by an extremely valuable paper by Professor Jenkin of Oxford University[1] and later by research work carried out by Mr. F. S. Merrils[2] in Bruntons Research Laboratory.

Internal Stress

Professor Jenkin, arguing from a study of simple models, suggested that the individual crystalline units in metals under certain conditions are in a state of internal stress, either tension or compression. When a load is applied, say in compression, those crystals which are already under compression will yield first and those under tension will yield last. If now alternate loads are applied gently the crystals gradually become stress-free. This was demonstated by Professor Jenkin's models and later it was found that metals in an internally stressed condition could be brought into the stress-free condition by applying alternating stresses: for example, Merrils showed that cold worked steel, in which the crystals are for the most part in tension, could be made stress-free by a few stress reversals in the Haigh machine. This stress-free condition is also reached in wire by blueing or low temperature annealing.

Heating

When the wire is in the freshly drawn condition it has no definite limit of proportionality because the crystals, being under various degrees of internal tension, begin to yield under very low externally applied tensile stresses and more and more crystals yield as the load is increased, so that we get the typical parabolic stress-strain curve for wire. When the wire is heated, however, as in tinning or galvanizing, it becomes definitely elastic, as shown by the curves in Fig. (2). The fatigue limit also is affected by blueing, as shown in Fig. (3). As is well known, however, blueing or galvanizing lowers the bends and torsions.

If we take a piece of high tensile wire and cut it into two equal parts, each about 100 diameters in length, blue or anneal one in order to bring it into the stress-free condition, leaving the other as drawn, and then bend them so that the extremities touch the curvature of the wires when set free they will be as shown in Fig. (4), from which figure it will be seen that the deformation in the annealed wire is much more localized than in the freshly drawn wire. The perfectly smooth curvature of the latter is due to the fact that the crystals were already under internal tension and yielding when the wire was bent occurred over a much greater portion of the wire, in other words, the deformation was not concentrated at any one particular point.

The significance of this in practice would seem to be that the drawn wire will have a longer life under bending stresses round pulleys, etc. The blued or stress-free wire, however, has a slightly higher fatigue limit and, if the bending stresses are such that this fatigue limit is never exceeded, the stress-free condition should be the more suitable. From general experience it would seem that the blued or stress free condition is more suitable for spring wire, while the internally stressed condition is more suitable for rope wire. This, however, will depend largely on the conditions under which the rope is worked and there would appear to be

(*Continued on page 170*)

Reverse Bend Tests On Wire Patented In Various Sizes and Drawn To 0.071 Inch Diameter

Each figure given for bends in the last column is the mean of at least 20 tests, i. e. 3 tests or more round each of the following radii: 2, 4, 5, 6, 7, 8 and 10 millimetres. Each bend round 180 degrees counted as 1, excluding the first 90 degree bend.

I. 55/60 Carbon Basic O. H. Steel.							
No. of passes in drawing	1	2	3	4	5	6	7
Total Reduction % in Area by drawing	28.5	50	64	74	80	85.6	89
Maximum Stress in tons per square inch	73	78	86	93	98	105	117
Average Bends round 5 m/m radius	25	18	24	20	22	21	22
Average Number of Bends round all radii	32	25	30	33	32	30	26
II. 0.80 Carbon Acid O. H. Steel.							
No. of passes in drawing	1	2	3	4	5	6	
Total Reduction % in Area by drawing	19	49.6	59	67.5	76.3	82	
Maximum Stress in tons per square inch	94	105	113	124	140	152	
Average Bends round 5 m/m radius	20	21	24	22	22	21	
Average Number of Bends round all radii	26	30	33	32	29	29	

1. "Fatigue in Metal": Jenkin. Journal of the Royal Aeronautical Society, Dec. 7th, 1922—Engineer, Dec. 8th, 1922, Vol. 134, pp. 612-614.
2. "Studies in The Fatigue of Metals": Merrils. Iron & Steel Institute Carnegie Memoirs, 1924.

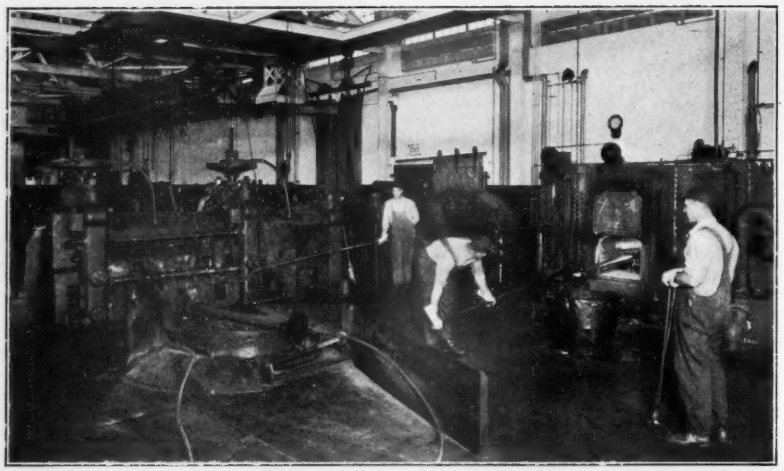


Fig. 2—View of Roughing Mill showing repeater on last pass.

Developments in Copper Wire-rod Rolling

A discussion of novel features of the Chicago copper rod mill of the Western Electric Co.*

By John R. Shea and Samuel McMullen
Western Electric Co.

RAPID developments in the various branches of the communication business are constantly leading to important investigations in line with more efficiently and economically meeting the increasing demands of the service. In this connection, one of the more recent and very interesting investigations indicated the possibility of effecting substantial improvement in the process of manufacturing copper wire. Accordingly; a comprehensive study of all the factors concerned was undertaken which resulted in the construction of a rod and wire mill at Chicago, Illinois, embodying many unique and improved operations, a schematic layout of which is illustrated in Fig. 1.

At the outset the sources of copper and its transportation were studied and it was found more economical to ship wire bars to Chicago for conversion into wire than to locate a wire mill near some of the large refineries and ship wire to the factory. It was also considered that this plan would reduce the investment in wire during the process of manufacturing cable and telephone apparatus.

Rod Rolling Mill

The rod rolling mill equipment consists of a billet heating furnace, a roughing mill, an intermediate mill, a finishing mill, coilers, conveyors, and pickling tubs. The mills are water-cooled and equipped with a downdraft exhaust which carries the fumes produced during the rolling operation to an air washer where the copper dust is removed before the air is discharged.

The 225-pound wire bars as received in cars from the refineries are unloaded onto skids in the train shed and transported by an electric truck to the charging end of the billet heating furnace. Here they are transferred in groups of six by a hoist to the charging table, where a compressed-air pusher moves them along through the furnace which holds 120 bars. The bars are brought up to the required temperature for rolling as they move through the furnace, which is heated by fuel oil. When the bars reach the opposite end of the furnace they are withdrawn at about 1600 deg. fahr. with a pair of tongs through the discharge door and pushed into the roughing mill one at a time.. These tongs operate on a trolley suspended from a beam, which is in line with the first groove of the mill.

The roughing mill consists of three motor-driven rolls, one above the other. The bar, after

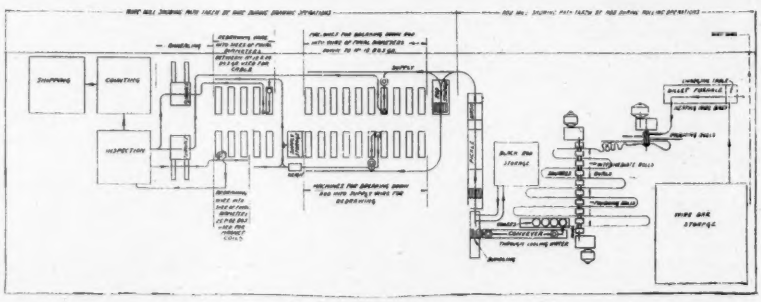


Fig. 1—Schematic layout of Western Electric Co.'s copper rod and wire mill at Chicago.

*Presented at the A. I. E. E. Winter Convention, New York, N. Y., February 7-11, 1927.

passing through the first groove between the top and middle roll, drops upon feed rolls set in the floor and is returned through the second groove, between the middle and bottom roll; then raised into position and passed through the third groove, which is the same rolls as the first pass. Five passes are made in this manner until its cross-section is reduced sufficiently for it to enter the intermediate mill. As the bar enters the roughing mill it is 54 inches long and about 4 inches square. When it leaves this mill it has been rolled into an oval cross-section and is about 124 feet in length. Formerly the last pass on this mill was handled manually, and recently a mechanical repeater has been added as illustrated by Fig. 2.

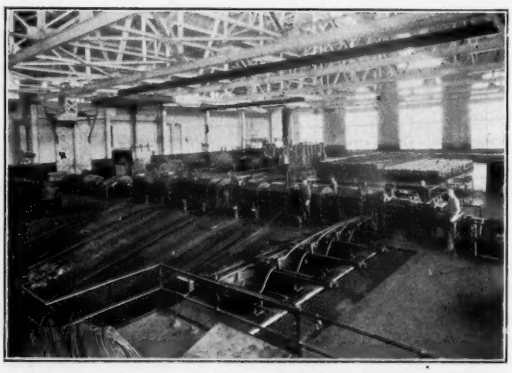
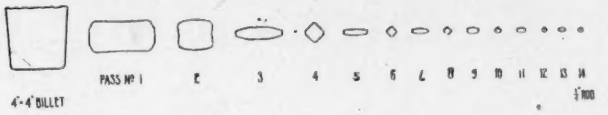


Fig. 3—View of Intermediate and Finishing Mills and coilers.

From the roughing mill the bar goes to the intermediate mill and is passed through the first pair of rolls. As it emerges an operator catches the end with a pair of tongs and passes it back through the next pair of rolls. The increased length between each pass at the intermediate and finishing mills is allowed to run out in a loop on a sloping iron covered floor on each side of the rolls. This catching and returning is repeated at each set of rolls until the original copper bar finally emerges a round, quarter-inch rod about 1200 feet long. This last pass goes through a guide pipe into a coiler, Fig. 3. The reductions in cross section are illustrated by Fig .4. An appreciable amount of copper oxide scale is carried off with the cooling water, and deposited in a reservoir from which it is later salvaged.

Fig. 4 — Rod mill reductions.



The coils are automatically unloaded from the coilers on to a conveyer, which carries them through cooling water in a tank underneath the floor. Eighty-two seconds after entering the roughing mill the bar is a coil of ¼ in. rod ready to proceed on its way to the pickling tanks. The mill has a capacity of 70,000,000 pounds annually on a 48-hour-per-week basis.

While the diagram and illustration of the intermediate and finishing mills indicate for simplicity that the rod follows only a single path, in actual operation sufficient material is kept in the mill practically to maintain at least two rods in the finishing mill.

When the rod mill was started eighteen passes were in use by several of the most modern mills. A sixteen pass arrangement was adopted for the new mill, in which the metal was subjected to a greater amount of work in the earlier passes when it was hot. Later, as a result of further study, fourteen passes were adopted.

It is obvious that careful planning must be done in changing the number of passes in a mill in order not to exceed the safe working capacity of the mill rolls and stands. Such calculations have been made using rolling mill formulas[2]. Based on the more sturdy mill installed at the Chicago plant the first four passes of the eighteen pass arrangement would operate at about 82, 100, 105 and 90 per cent of the safe working load of the mill. These same passes calculated on the basis of the sixteen and fourteen pass arrangement operate at 86, 87, 90, 95 and 96, 96, 90, 90 respectively. This indicates that a further reduction may be made in the number of passes in the mill provided other features are improved; i. e., roll adjustment.

Relation Between Working and Physical Properties

It has often been stated that the more passes (i. e., the more gradual working) given the copper, the better the physical qualities of the rod. Actual tests (see Table I) made on representative lots of ¼-in. rod fail to confirm this impression.

The averages indicate that a fourteen-pass rod is superior in elongation, and better than the total average in tensile strength.

Cleaning of Rod.

When the coils emerge from the tank through which the rod coiler apron conveyor passes, they are cool enough to handle and after being tied with wire, several are lifted together by a monorail crane, and placed for thirty minutes in a pickling tank containing from 5 to 10

(*Continued on page 166*)

TABLE 1

Lot	Number of passes	Elongation per cent	Tensile strength lb. per sq. in.
1	18	35.8	33,752
2	18	40.0	31,445
3	16	37.1	32,468
4	16	41.0	32,160
5	14	42.0	32,391
	Average of 5 lots	39.5	32,243

2. "The Theory and Practise of Rolling Steel," Wilhelm Tafel.
"Pass Limitation in Rolling Miss Practice," Machinery, July, 1918.

Research on Mechanical Properties of Steel Wire

The first installment of a series of articles on recent investigations in Germany

By Dr. Ing. Wilh. Pungel

(Translated from Stahl v. Eisen) *

IN judging the quality of drawn steel wire the flexibility and torsion test numbers play a deciding role in addition to the tensile strength. The

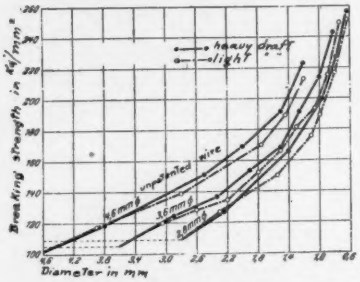


Fig. 1—Steel A. Change in tensile strength due to cold working.

purpose of the inquiries recorded here was to determine in what degree the mechanical properties of drawn steel wire are dependent on natural hardness and elongation due to drawing, and whether the determination of the ultimate bending strength permits a conclusion as to the bending and torsion test numbers.

Further, the attempt will be made to obtain the ready means of determining quickly the most practical production method for any kind of wire through choice of a single method of management.

The investigations extended more particularly to the determinations of tensile strength, of the number of bends around a given diameter and of the number of torsions. The determination of tensile strength was made on a 3-t-Tensile machine.

In the flexion test the wire was gripped between two jaws of certain curvature and alternately bent through 90° to either side. The movement from one limiting position to another was counted as one bend. In general, the bendings were so adjusted that wires of diameters larger than 1.0 mm. were bent over a radius of 5 mm. and those of smaller diameter over 2½ mm.

As the standard for the determination of torsion specimen length for wires of over 2 mm. diameter a length of 200 mm. and for thinner wires in length of 150 mm. was chosen. A turn of 360 degrees count as a torsion.

Flexion radius and the length of test specimen condition, in this way, only very roughly, the influence of diameter on the test wire. With constant flexion radius, and with constant length, the flexion and torsion test numbers rise to considerable extent with diminishing diameter of the test wire; whereby the conditions of flexion and torsion become always more favorable.

The usual manner of testing can therefore give no satisfactory information about the quality of the wire. In order to get a comparable standard for these tests, the bending test will be so carried out that the wire will be bent over a radius of twice the diameter. (bending radius, r=2d). To this end an additional flexion test apparatus was built to supplement the previous one, in which the jaws could be easily interchanged. The flexion radius ranged from 10 mm. to 1 in steps of one millimeter. As the specimen length, a standard was established which corresponded to 100 times the diameter of the wire. The alternate torsion and the uniformity of the material was tested. The former was drawn into the investigation, because the greater majority of wires used in practice, namely (hoisting and crane ropes) in addition to being judged for flexure are considered also with reference to the continously changing twists. It was carried out in such manner that the wire was alternately twisted four times through 360 degrees in either direction. The number of such twist to rupture

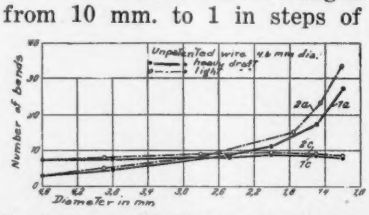


Fig. 2—Change of flexibility due to cold working. 1a, 2a, Bending radius: 5 mm; 1c, 2c, Bending radius: 2 dia.

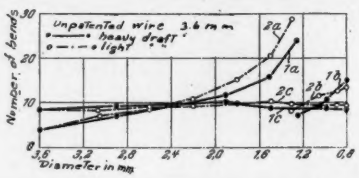


Fig. 3—Steel A. Change of flexibility through cold working. 1a, 2a, Bending radius: 5 mm.; 1b, 2b, radius 2.5 mm; 1c, 2c, radius 2 dia.

give the alternate torsion of the raw material.

In support of the test of uniformity of music and spring wire, the uniformity in hardness of raw material was proved by means of the so-called "long loop," in this manner that two wires of equal dimensions were laid parallel and were twisted about one another in one direction until fracture occurred. As the length of the test specimen, again, 100 times the diameter was taken. Inequalities in raw material shown themselves in this way that in places of less strength tighter torsion showed or the wire broke.

As raw material rolled rod of

*For bibliography reffered by numbers in text see end of article page 170.

5:3 mm. dia. was used, and of four different makes which because of their differing high carbon content differed only in hardness. The qualities of the wire rod are indicated in table 1.

It must be remarked concerning the investigation that all these numbers and curves which are given here apply only to drawn wire which has been heat treated, and with which the patenting processes were used, (heating in continuous oven, and quenching in lead bath)[2]. The procedure of the tests in all stages was as follows: Pickled rod of 5.3 mm. dia. was passed through a number of dies of various diameters, for instance, 4.8, 4.6, 4.4, etc., to 2.8 mm. dia. in steps of 0.2 mm. with one or more passes. After further annealing in patenting ovens the wires were further prepared for drawing in the usual manner (washed, limed, dried). The wires were then drawn down until by the "nail-test" (whereby the wire is bent over the thumb,) it is shown overdrawn, or defective. When this outer limit for working is reached,

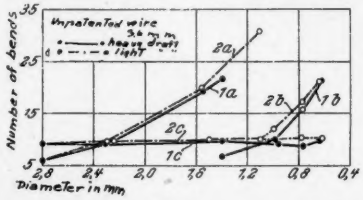


Fig. 4—Steel A. Change in flexibility through cold working. 1a, 2a, bending radius: 5mm: 1b, 2b, radius 2.5mm; 1c, 2c, radius 2 dia.

(which is essentially dependent on carbon content) the wire splits. In general, a specimen is taken from both ends of the rolls of wire, in order to obtain an average of the strength, and to determine the influence of the sampling. (from the front or rear end of the wire). In the course of the investigations, it appeared that the form of at least the tensile test curve could be sufficiently determined by taking test specimens of only every second draft, because the process of change of tensile strength could thus be determined with sufficient certainty and extent. For the determination of the flexion and torsion test numbers it was necessary to take tests after every pass.

Table I. Results of Tests on Rods

Steel	Carbon Content %	Elastic Limit Kg/mm²	Tensile Strength Kg/mm²	Elongation l=100 mm %
A	0.62	48.5	78.0	15.5
B	0.50	37.5	64.0	22.5
C	0.41	29.6	53.5	24.0
D	0.24	26.5	45.0	25.5

In order to determine the effect of drawing on the tensile strength in its relation to the original wire, it appeared necessary to go through a comprehensive examination with at least one material. This series of tests (Material A=0.62%C) was followed by investigation of steels B, C, & D, in shorter form, which were however sufficient to confirm and complete the results attained for Steel A.

Test Series A; Steel 0.62%C

In order to determine the effect of the drawing process on the strength, wire with greater and less reduction from draft to draft (called heavy and light drafts) was examined in such a manner that one half of every drawn and hardened roll of wire was drawn down with a heavy draft and the other half with light draft. Goerens[3] had found that in case of wires which are drawn with large reduction, the strength increases almost proportionately to cold-working, whereas in cases of light drafts the curve for the tensile strength has a very irregular shape and the tensile strength of the wire does not reach the same point as in the case of the other. Eicken and Heidenhain[4] have also come to this last conclusion. This phenomenon is also known in practice but it has not yet been explained. In Table 2, several examples of the sequence of drafts of fresh drawn wire are given.

Since the shape of curves for all freshly drawn wire (unpatented) was the same (4.8 to 2.8 mm. dia.) it appeared sufficient to give a graphic representation of the relations of a few of these wires. In Fig's. 1 to 7, results have been brought together which have been reached with rods 4.6, 3.6, and 2.8 mm. dia.

1. Tensile Strength

Fig. 1 shows the change in tensile strength with increased working. The strength of the drawn wire increases as the diameter is reduced. This increase in tensile strength with reduced diameters in the case of smaller dimensions must be attributed to more thorough heat-treatment or further cold working. The deviation from the average tensile strength is nevertheless very small. So the value of this tensile strength of the unpatented wire of 4.8 mm. dia. is 102 kg. per mm.² and of furthest reduced wire of dia. 2.8 mm. dia. is 109 kg. per mm.². The deviation from the average

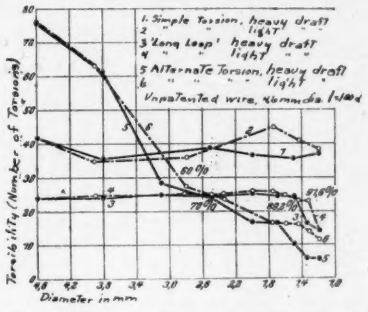


Fig. 5—Steel A. Change in torsibility due to cold working.

(*Continued on page 167*)

Hartedraht	Zieheisen	1. Zug			2. Zug			3. Zug			4. Zug			5. Zug			6. Zug		
		auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b
4,8	Starker Zug	4,0	30,6	30,6	3,3	35,4	55	2,85	30	70	2,3	31	79	1,85	30	85,3	1,55	30	89,7
	Leichter Zug	4,1	27,3	27,3	3,5	28	47,1	3,0	27	55,5	2,55	27,5	72	2,2	23	79	1,9	25,5	84,4
4,0	Starker Zug	3,3	32,3	32,3	2,7	33	54,9	2,2	34	70	1,8	32,6	79,8	1,5	30	86	1,25	30,3	90,4
	Leichter Zug	3,45	25,8	25,8	3,0	27,5	44,8	2,6	26	51,7	2,2	29	70	1,8	32,5	79,8	1,55	29,1	85
2,8	Starker Zug	2,25	35,3	35,3	1,75	37	61,0	1,4	36	75	1,1	37	85	0,97	21,4	88	0,87	20,0	90,3
	Leichter Zug	2,3	32,5	32,5	1,9	32	54	1,55	32,5	69,5	1,3	28	78,5	1,1	27,5	85	0,99	18,3	87,7

	7. Zug			8. Zug			9. Zug			10. Zug			11. Zug			12. Zug			13. Zug		
	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b	auf ∅ mm	% a	% b
1,55	24,3	92,2	1,8	21,0	93,6																
1,85	24,7	85,2	1,8	17,8	90,4	1,55	13,9	92,3	1,3	21,0	93,7										
1,05	21	93	0,9	24,7	93	0,8	21,3	96													
1,35	24,1	89,7	1,20	21,0	91	1,05	38	93	0,92	33	94,6	0,83	18,9	95,7	0,76	11,5	96,4	0,70	7,5	96,9
0,77	21,1	93,6	0,69	19,6	94	0,62	19,4	95													
0,89	19	90	0,79	21,3	92	0,71	19,3	93,6	0,63	21,3	95										

Table 2 — Reductions in drawing.

The English equivalents of the German terms used in the table are: HARTEDRAHT, unpatented wire; ZIEHWEISE, way of drawing i.e., whether by heavy reductions (Starker Zug) or light reductions (Leichter Zug) ZUG, draft.

a: percent reduction based on preceding diameter

b: percent reduction based on initial diameter

Wire Forming Applied to Ring Manufacture

By F. Server

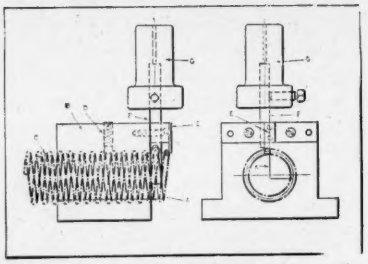


Fig. 1—Die for cutting off rings from coil.

AMONG the incidental jobs encountered in nearly every factory is the making of rings as a part of some device. The production of these rings is often a very troublesome problem, particularly when it is not approached in a correct manner. In the accompanying illustrations are shown a number of dies that have been used successfully for cutting off, bending, and forming wire into rings.

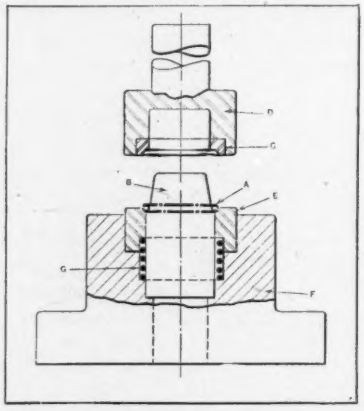


Fig 2—Die for aligning and closing ends of ring.

Cutting off Rings from Coil

In Fig. 1 is shown a die that cuts off rings from a coil A, which has been previously wound in the form of a spring. These rings are afterward placed in the die shown in Fig. 2, which closes the joint and bends the ring into shape. The cutting-off die shown in Fig. 1 consists of a block B with a hole through the center which has a threaded groove conforming to the helix of the spring. In this hole is placed a round arbor which also has a groove cut in its outer periphery to conform to the inner helix of the spring. Screw D holds the round grooved arbor in position, so that the coil spring A will pass through the groove when screwed in from the left-hand end until the right-hand end comes against a stop E, which is attached to the end of the die. The end of the guiding arbor is cut away, so that it forms an edge X against which the cutting-off tool F shears off one coil of the spring at each stroke of the press.

Cutter F is clamped in a holder G which, in turn, is attached to the ram of a foot press, and its lower edge is grooved to conform to the radius of the wire. In using this die, the operator merely screws the coiled wire into the die until the end comes against the stop, and then trips the press. As the cutter descends one ring is cut off. The spring is again screwed in until the end comes against the stop, and at the same time the ring previously cut off is removed if it does not fall off. Then the cutter descends and cuts off another ring. This operation is repeated until the end of the spring is almost reached, following which another spring is threaded into the die. The new spring pushes out the short end of the preceding spring.

Die for Aligning and Closing Ends of Ring

After the required number of helical rings are cut off, they are next placed, one at a time, in the die shown in Fig. 2. The ring A is placed over a mandrel B in approximately the position shown. A conforming ring C in the holder D of the ram then descends, and the ring is forced over the mandrel B into the position shown at A, where it is pressed against a form E, which gives it the desired symmetrical ring shape with closed joint.

The lower conforming ring E is placed in a holder F which, in turn, is attached to the bolster plate of the press. A spring G is compressed by the conforming ring E as the punch descends. After the conforming operation is completed and the punch goes up, spring G causes the conforming ring E to strip the work A off the mandrel B, thereby raising it slightly above the position shown, so that it can be flipped out of place with a sharp pointed instrument, following which another ring is put in position. The tools shown in Figs. 1 and 2 are adapted for making small rings in moderate quantities.

The tool equipment of a slide-operating machine for automatically forming rings is shown in Fig. 3. In this machine, rings are formed from wire by a series of forming dies, which successively bend the work at different points to form the complete ring. The wire A is taken from a reel and passed through a series of straightening rolls at the left—not shown. The slide B then clamps the work and feeds it in the direction of the arrow C until it comes against the stop at D, in which

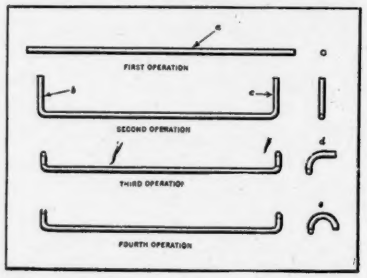


Fig. 4—Sequence of operations in forming wire piece.

position it is clamped by a rocker arm E, so that it can be released by the slide B. The rock-

er arm then returns and grips another piece, ready to feed it along after the forming operations have been performed on the first piece.

The wire, as it is fed forward, passes through a bushing F, which acts as a die for the cutting-off tool G, the slide on which the tool is mounted being operated in the direction of the arrow H. Previous to this cutting-off operation, the circular shaped form tool advances in the direction of the arrow J, and just comes in contact with the work at X, so that it is held against the arbor K, shown in cross-section. This is the first operative position preliminary to the forming.

At the second position, the slide J is advanced, so that the work is formed to the shape shown on the arbor K in the view illustrating the second position. The slide J then dwells in this position while slides L and M feed toward the center of the arbor K in the direction indicated by the arrows, to complete the forming of the ring as shown by dot-and-dash lines in the view in the lower left-hand corner.

The slides, J, L and M then return to their starting positions, as shown in the first operation view, while the arbor K recedes and allows the ring to drop out of the machine, following which another piece of wire is fed against the stop. Briefly stated, the operations on this forming machine consist of feeding the wire against the stop; clamping the wire and cutthing off; forming the U shape; and forming both ends to bring the work to the shape shown by the finish-forming position in the lower left-hand corner.

Combining Machining and Forming Operations

A particularly good feature of this type of machine is that certain incidental operations can be performed on it when necessary. The equipment for two such operations is shown in the two views at the lower right-hand corner of Fig. 3. The operations are performed with this equipment while the work is in the shape shown at the second position, or in other words, while it is clamped by slide J against arbor K. In the first operation, a slide feeds forward in the direction of the arrow P, carrying a milling cutter Q, revolving to the right, which mills the end of the work. During this operation the work is supported by a guide bar R, which is also mounted on the slide. After the work is milled to the required depth, the slide returns to its original position.

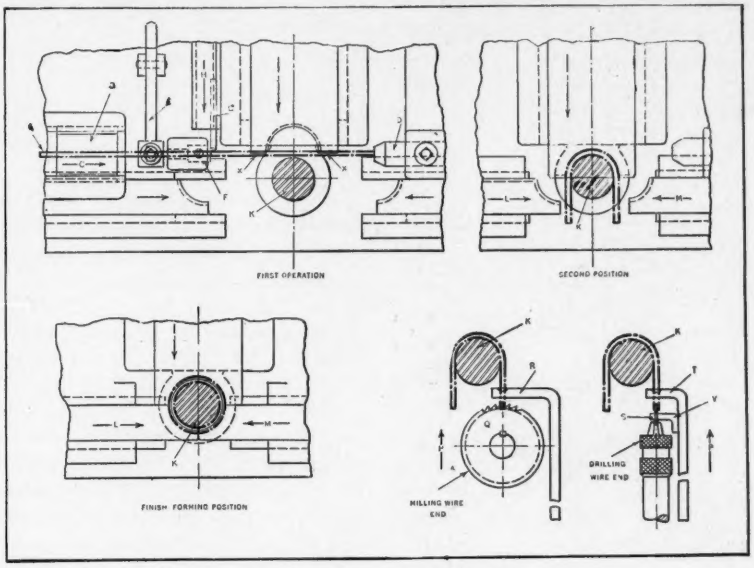


Fig. 3—Automatic slide type of ring-bending equipment.

To the right of the milling equipment is shown a drill S performing the operation of drilling a small hole in the end of the formed work. The work is supported in a bar T to which is attached a drill piloting angle V, which acts as a guide for the drill. The machine operates in the same manner as for the operation just described. This slide type of machine is automatic in action, and it may be used for such jobs as forming half rings or circular parts with shapes on their ends, although certain modifications of the forms and slide would be necessary.

Die for Forming Ring Segments

A very simple die that can be used for making ring segments is shown in Fig. 5. It consists of a base A which is attached to the bolster plate of the press, a steel block B, mounted on the base and attached to it by screws which are not shown. To the side of this block is attached a hardened steel plate C. Wire is fed through the block B around a curve X, and pushed in the direction of the arrow D by means of feeding rolls or a feeding slide until the end of the work comes against the surface Z of block B, which acts as a stop. A cutter E, attached to the holder F by means of the screw G, then descends and cuts off the ring segment. The segment falls out of the machine, and the wire is again fed forward around the curve, after which the operator trips the press and makes another ring segment. Block B is made in two half sections, being parted on the center line of the wire, as indicated at H so that the shape X can be cut in it; the two half sections are then screwed and doweled together to make one block.

Forming Both Ends of Wire Piece Simultaneously

The operations shown in Fig. 4 are performed on a machine embodying the features shown in Fig. 6. The general principle of operation of this machine is based on slide units similar to those shown in Fig. 3. The wire X, Fig. 6, passes through

Heat Treatment of Chains

IN THE latest annual report of the National Physical Laboratory reference is made to work which is being carried out in connection with the heat treatment of chains, which is a practice—in some cases a statutory requirement—whose object is the removal or partial removal of the hardening and embrittlement produced by the strains and shocks to which chains are subjected in practice. The main object of the present research is to study the effects of, first, low-temperature annealing (650 to 760 deg cent.), and, secondly, normalizing, upon the mechanical properties of chains which have been subjected to varying degrees of plastic strain.

(*Continued from page 159*)

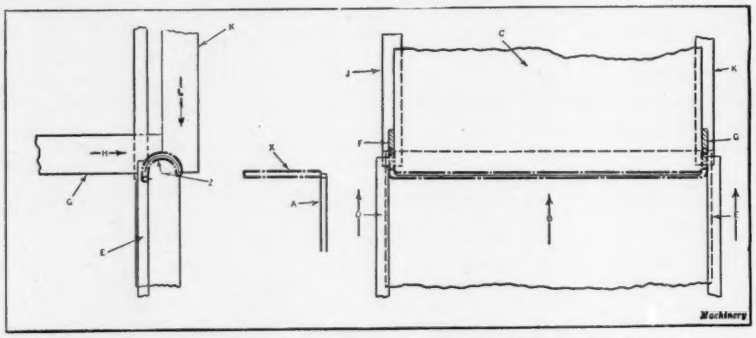


Fig. 6—Die for performing sequence of operations illustrated in Fig. 4.

straightening rolls as it comes from a reel, and is fed out to the length a, Fig. 4. It is then cut off by cutter A, Fig. 6, and clamped in place by the slide block B, which is fed upward until it clamps the wire against the stationary formed block C. The blocks B and C have grooves cut in them to conform to the shape of the wire. The two end forming plungers D and E are fed in the direction of the arrows, so that they bend over the ends of the wire to the shape shown at b and c, Fig. 4.

An integral part of the formed block B, Fig. 6, has a section formed to the radius Z which, of course, advances as the block B moves in and clamps the part in the position shown. After bending the ends of the work, two plungers F and G, advancing as indicated by arrow H, bend the end of the wire over, producing the shape shown at d, Fig. 4. After this, two slides J and K, Fig. 6, advance from the back in the direction of the arrow L, thus producing the finished piece shown at e, Fig. 4. All of the slides then return to their initial positions, and the same series of operations is performed on another piece of wire. The slides on the machine described are operated by cams and levers, the same as on wire forming machines, the chief requirement being sufficient rigidity to set the wire so that it will retain its shape after being formed.

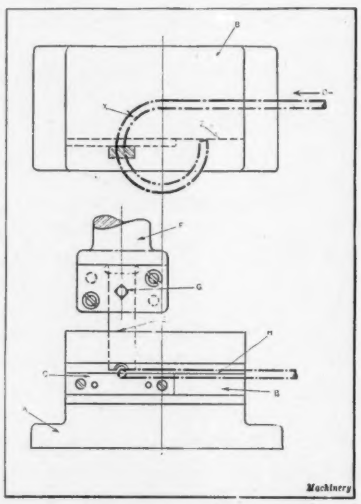


Fig. 5—Die for forming ring segments.

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The work performed to date includes the following: A ¾-in. chain, in the condition in which it was received from the manufacturers and the proving house, has been subjected to a number of overstrainings produced by either static tensile loading or impact tensile loading. One, two, and three overstrainings were employed, with intermediate and final heat treatments. The tests made led to the following conclusions:

1. Where static tensile overstraining forces were employed: (a) The total energy to fracture of a chain subjected to repeated straining followed after each strain by either annealing or normalizing, is much greater than the energy to fracture of a sample which has not been subjected to intermediate heat treatment. The final breaking load remains, however, generally unchanged. Normalizing possesses no advantages over annealing in this respect, both being regarded as satisfactory treatments. (b) Although repeated overstrainings and annealings produce a somewhat reduced value of the tensile strength of the material of which the chain is composed, no indication of any "shortness" is disclosed by a static tensile test. (c) Tensile impact tests made on specimens cut from links and normalized on receipt at the laboratory showed that the energy absorbed to fracture was somewhat reduced by a combination of overstrainings and annealings. In no case, however, did this value fall below that of the material in the condition "as received" (ie. after manufacture and a single "proofing"). Intermediate and/or a final normalizing treatment somewhat improved this value. (d) Notched-bar tests on specimens cut from chain links showed that the energy absorbed to fracture is greatly reduced by repeated overstrainings followed by annealings. A

(*Continued on page 166*)

Distribution *of* Energy *in* Worked Metals

Effect of process annealing temperature on the final annealing temperature of fine copper wire*

By Lyall Zickrick and R. S. Dean

Metallurgical Engineers, Western Electric Co., Inc.

As a result of the studies on recrystalization and crystal growth made in this laboratory, certain theories have been developed. These are expressed briefly in a paper by Dean and Hudson.[1] One of the principal points brought out in that paper is that in the deformation of a crystal, the energy supplied is distributed to the atoms of the lattice, probably by the forced formation of molecules. It is found that a Maxwellian distribution of the energy among these atoms will account for the grain growth at various temperatures. According to such a distribution the number of atoms

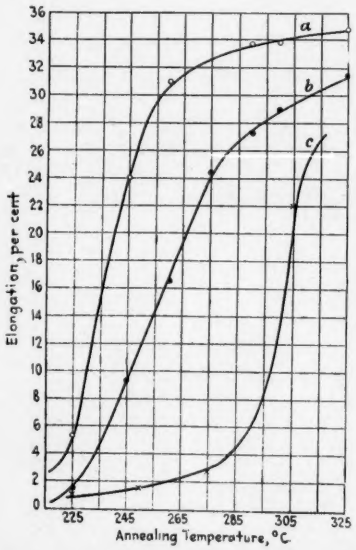

Fig. 1—Results of Annealing Tests on 34-gage wire all drawn from the same supply.
a, annealed at 400°C. at 22 gage, which gave 24 per cent E;
b, annealed at 220°C. at 22 gage, which gave 23 per cent E;
c, same wire as used in b drawn to 27 gage, with anneals at 250°C. between dies, then drawn to 34 gage.

with energy above a certain critical value, E, necessary for recrystallization at the absolute temperature T is given by $n = Ne(-E/kT)$ where N is the total number of atoms.

It is apparent that if this line of reasoning is correct, a metal which has been cold-worked and reheated to a temperature below that of complete annealing will have the atoms with the higher energy recrystalized, that is, reduced to normal energy and there will remain only atoms below a certain energy. If this metal is again cold-worked the peak in the number-energy distribution curve will be displaced toward the regions of lower energies, that is, higher temperature of recryastallization. By a repetition of this process the position of this maximum and hence the recrystallization temperature of the metal could be raised considerably.

In order to check this theory, experiments have been made on copper wire. The wire was drawn from ¼-in. rod to 22 B & S gage and then sample lots were annealed at 400 and 220° C., respectively. The wire annealed at 400° C. gave an elongation of 34 per cent., whereas that annealed at 220° C. gave only 23 per cent. These wires were then drawn by identical practice to 34 B & S gage and the elongation determined after an anneal of 3 mm. in an oil bath held at various temperatures. The figures obtained have been plotted in Fig. 1 It will be seen that the result is in accord with the theory, the partially annealed wire (that is the sample annealed at 220° C.) requiring a higher temperature to produce the same elongation.

In order to check the effect of repeated partial anneals, a portion of the 22-gage wire annealed at 220° C. used in the above experiment was drawn to 27 B & S gage wire with a 3-min. anneal at 250° C. between each pass. It was then drawn to No. 34 gage and the temperature-

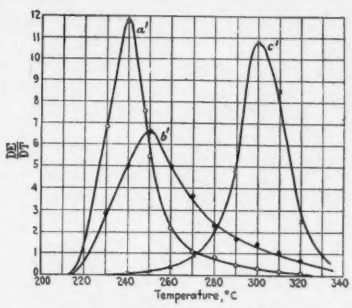

Fig. 2—Data of Fig. 1 replotted.
a, taken from curve a, Fig. 1, wire thoroughly annealed before drawing;
b, taken from curve b, Fig. 1, wire partly annealed before drawing;
c, taken from curve c, Fig. 1, wire partly annealed between dies during drawing.

elongation curve determined as before, that is, by annealing 3 min. in an oil bath held at various temperatures. These results are also plotted on Fig. 1 and record a striking confirmation of the theory.

In Fig. 2 the data shown in Fig. 1 has been replotted in the form of dE/dT against T, where E is the elongation and T the temperature. The differential dE/dT is accordingly proportional to the number of atoms recrystallizing at any given temperature, that is, of a given energy, hence these curves are of the form of Maxwellian distribution curves. The displacement of the maximum toward higher temperature is very clearly shown.

It has accordingly been shown that the annealing temperature of hard-drawn copper wire depends to a marked degree on its previous treatment as regards cold working and annealing.

[1] R. S. Dean and W. E. Hudson: Grain Growth in Lead Antimony Alloys. Jne. A. C. S. (1924) 46, 1778.

*Presented at meeting of Amer. Inst. Min. & Met. Eng. Feb. 1927.

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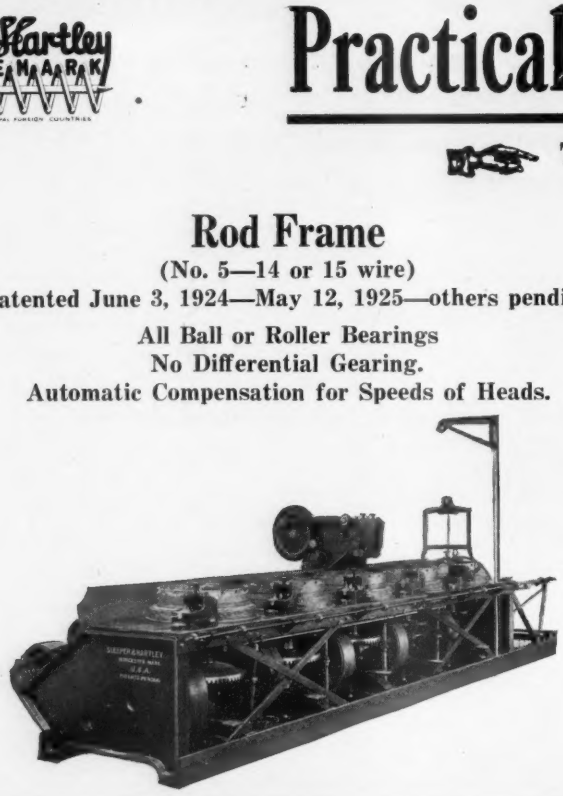
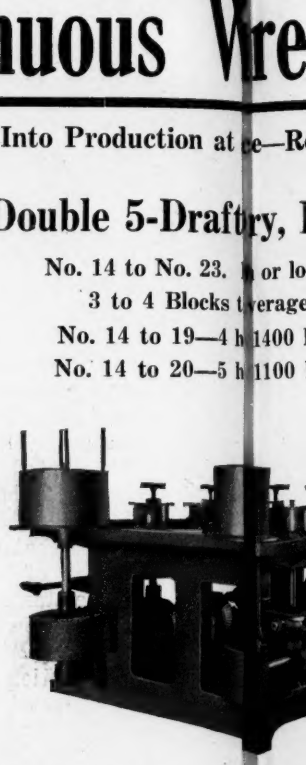


Double 5-Draftry, [illegible]

No. 14 to No. 23. [illegible] or lo
3 to 4 Blocks [illegible]verage
No. 14 to 19—4 h[illegible]1400
No. 14 to 20—5 h[illegible]1100



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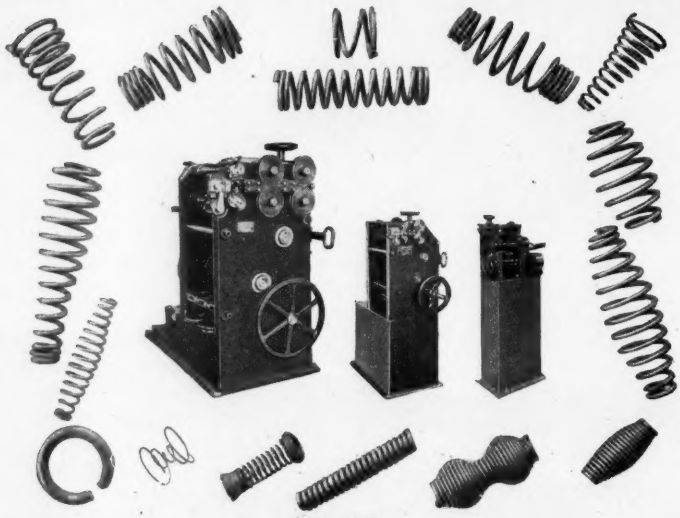

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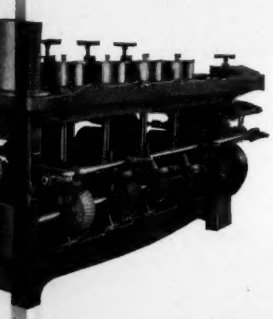
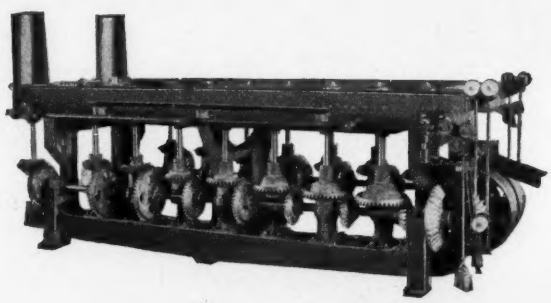


Double 8-Draft Fine Wire: Wet

No. 22 to 36. High or low carbon wire.

6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.



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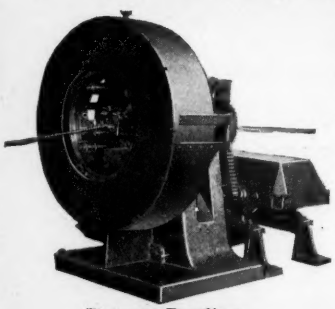

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EDITORIAL · IMPRESSIONS

Trade Consciousness

THIS is the first anniversary number of Wire & Wire Products. A review of the first year's work in editing this journal shows a marked increase of interest in trade literature among the men in the industry. A growing interest too, is manifest in recording and publishing individual shop experience and sales practice and with this goes a steady improvement in contributions to the magazine.

But the trade is remarkably slow in developing any solidarity such as the common interest of its members would justify. Members of the wire industry are not "trade-conscious". Well, why should they be?

Because to be interested in the trade at large is the first step towards a proper orientation in the industry and it is undeniably important to know where you stand with reference to other members of the trade. Do you know the present trend of your industry? How far ahead can you predict its normal future? What preparations should you make to meet the progress of your firm which is inevitably linked to the collective trade development? These are questions no individual manufacturer could answer except on the basis of statistics covering the whole industry.

A trade journal like Wire & Wire Products is the logical nucleus about which such collective interest in the industry should be built. But there are limits beyond which the editors cannot go without the organized assistance of the readers. What such collective effort could accomplish has been recently ably stated by the head of one of the largest trade associations in the country, whose suggestions we summarize here:

1. Appeal to the ultimate consumer to create preference for articles made of wire.
2. Advertising on the part of mills to distributors and fabricators.
3. Research and standardization work which the individual could not afford.
4. Cooperation with building and electrical trades.
5. Gathering of trade statistics.
6. Credit and collective work.
7. Uniform cost accounting.
8. Extensive study of overhead.
9. Uniform merchandising.

Why not in America?

ELSEWHERE in this issue we publish two articles dealing with the results of important research on wire. One of them is written by Mr. A. T. Adam, the author of the foremost treatise on wire drawing of steel. The other is the first installment of a series of articles on the mechanical properties of wire, to be published in Wire & Wire Products.

Aside from the importance of these studies and the skill of the men who undertook them what impresses us is that both contributions come from abroad. The first is from England where the wire industry can boast of a centrallized research laboratory. The other is from Germany where some universities are actively engaged in research on the problems of wire manufacture.

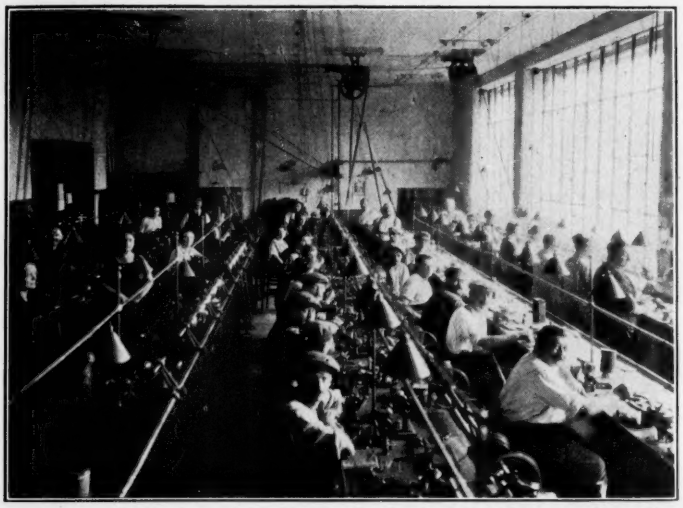
Though these problems are as important in this country as elsewhere we are not aware of much activity in this direction, and such as there is, is being kept more or less secret. It is hardly necessary to stress the value of research work in the industry. What can be accomplished in this direction is vividly indicated by the series of contributions being published in this magazine on the work of the Western Electric engineers in the development of new types of machinery for wire drawing. More of such work needs to be done in this country. A great deal is being accomplished in Europe and if in Europe, why not in America?

Waste in Distribution

WE are pleased to yield this space to the forceful statement of Alvin E. Dodd, manager of the department of domestic distribution of the Chamber of Commerce of the United States: "The next step in economic progress in the United States will be to carry the war on waste into the field of distribution." Mr. Dodd said further, "The waste in distribution is as obvious as the waste in production. There are a variety of business practices, such as overselling, cancellations and returns, delays in deliveries, unethical credit practices, discrimination—every one of which lays the basis for a potential dispute, and disputes are a source of waste as definite as the destruction of materials or fruitless expenditure of labor. These are not the fault of the individual distributor alone, nor can he alone supply the remedy. The practices have crept into distribution. Perhaps they have displaced more wasteful practices. But if they are to be eliminated, they must be dealt with by business collectively, by the manufacturer, the wholesaler and the retailer.

The war on waste in distribution has opened. To be successful it must be carried on incessantly and with unremitting vigor. Production must know the capacity of its market, if it is not to commit the error of creating surpluses of commodities. It is the business of distribution to determine what this capacity is and the most economical and expeditious way of fighting it."

VIEWS OF THE WIRE WORLD



Interior of a corner of the diamond die polishing and finishing department of a typical French die manufacturing plant. The photograph was taken at the Ballofet Diamond Wire Die Co.

Another view of the Ballofet Plant in France showing a corner of the diamond die drilling department.

New cable ferry in France. This ferry in Rouen, France is held by cables and runs much smoother and quicker than the usual ferry.

If you have photographs of interest to the Wire industry, send them to Wire & Wire Products

Developments in Copper Wire Rod Rolling

(*Continued from page 155*)

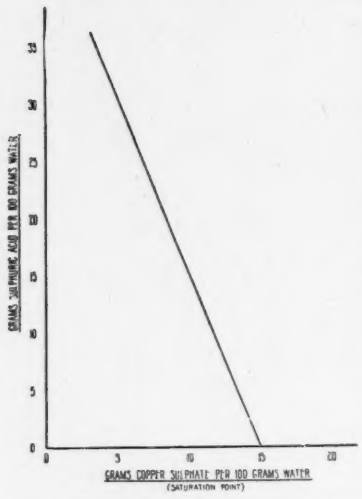


Fig. 4—Solubility curve of copper sulphate in a sulphuric acid solution (Temp. 25 deg. Cent.) Reference Table of Solubilities by Sidell, Chem. & Met. Eng. Vol. 21, p. 181-2, 1919.

per cent free sulphuric acid, in order to remove the black oxide caused by oxidation of the hot copper in the air during rolling. The solution is maintained at approximately 10 deg. fahr., and the copper content varies from one to three grams per 100 cu. cm. Experiments have shown a difference of less than 10 per cent in pickling time between the minimum and maximum acid used, the greater solubility being obtained from the weak solution. Actual results obtained were checked with Sidell's Table of Solubilities (See Fig. 4). While a variation from the minimum to maximum acid concentration does not materially affect the pickling time, a variation in temperature has a decided effect as may be seen from Fig. 5.

Electrolytic Plant

Fig. 6 shows a plant in which the copper is reclaimed from the pickling bath at about the same rate as it is absorbed. This is accomplished by electrolytic deposition.

The electrolytic system operates best with a minimum content of about 1 per cent copper and 5 per cent acid and a maximum of 3 per cent copper and 10 per cent acid. The copper and acid contents are kept as low as practicable to minimize "carrying out losses"[3] during the pickling operation. About 775 pounds of acid, and 430 pounds of copper are recovered per day from the electrolyte. The anodes are operated at a current density of five amperes per square foot with a rate of deposition of about 0.00261 pound of copper per ampere-hour.

The heat generated in the plating tanks under normal operating conditions means a minimum temperature of about 90 deg. fahr., throughout the acid system, and the maximum temperature is obtained through steam heating coils in the pickle tanks. Faster pickling would result from the use of higher temperatures but experience has shown that the additional steam and gas released above 120 deg. fahr., results in unsatisfactory operating conditions.

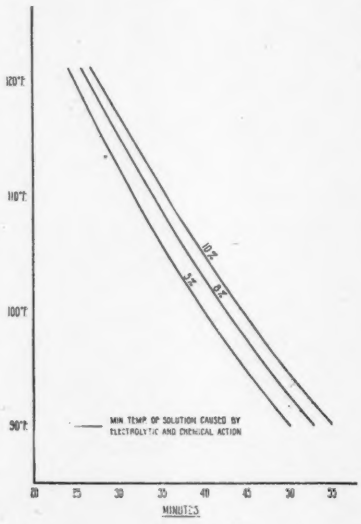


Fig. 5—Rate of Pickling at Practical Acid concentration. Max. temp. without excessive evaporation and fumes.

3. Pickling solution carried out when coils are removed from tank.
4. Lake water is relatively free from mineral salts which would corrode the rod and affect the wire drawing compound.

Fig. 6—Electrolytic recovery of copper from rod mill pickling solution.

The coils of rod after pickling are thoroughly washed with lake water[4] at a pressure of about 70 pounds per square inch to remove loose copper dust and acid, and then immersed in an alkaline fat solution to neutralize any trace of acid and to provide a protective coating against oxidation until converted into wire.

The second part of this article will appear in the June issue of Wire & Wire Products.

Heat Treating Chains

(*Continued from page 160*)

final normalizing process tends to restore the material.

2. Where tensile impact overstraining forces were employed: (a) In the tensile impact tests to destruction the fact was clearly brought out that a progressive deterioration of the welded portions of the link took place due to the shocks employed in the overstraining processes. In nearly every case fracture finally occurred at a welded joint. The intermediate heat treatment, whether normalizing or annealing, had of course no effect on this deterioration. In the few cases where failure did not occur at the weld the values of the energies to fracture showed that combinations of overstrainings and annealings had not produced any brittleness in the chain as a unit. (b) As in the case of chains subjected to static tensile overstraining, tensile and tensile impact tests made on specimens cut from chain links failed to show any marked deterioration in the properties of the material due to combinations of overstrain- and annealing. (Mech. World, Nov. 5, 1926, p. 363.)

Experimental Research on the Mechanical Properties of Steel Wire

(*Continued from page 157*)

tensile strength is 3.5 kg. per mm.^{2} The tensile strength increases with additional working proportionately to the working in the beginning, and at a faster rate with greater reductions. One might have expected that curves with a small difference in drafts i. e. or light and heavier reductions (see Table 2) would not deviate much from each other. But as Fig. 1 shows, the tensile strength value of wire drawn with light drafts is always lower than that of wire drawn in heavier drafts. The greater irregularity in shape of

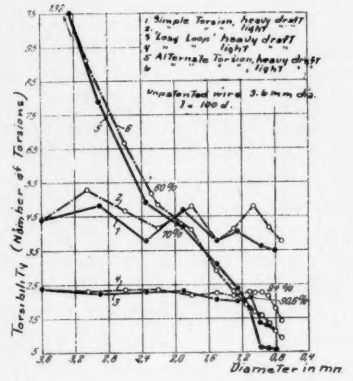


Fig. 6—Steel A. Change of torsibility due to cold working.

the curves for wire drawn on heavy drafts found by Goerens, we cannot corroborate. In general, both curves assume similar shapes. As the illustration further shows the difference in the tensile strength between the two kinds of drafts gradually increases as the reduction in cross section increases. The extreme deviation in tensile strength of the finished wire amounts in general to from 5 to 10 kg. per mm.^{2} with equal total cross-section reduction.

In order to get a view of the increased working, the tensile test numbers of wire which were obtained from unpatented wire by different cross-section reductions have been given in Table 3. In addition the average values for heavy and light drafts are given, as well as the tensile strengths corresponding to various diameters obtained by the said reductions.

As these results show, equal cross section reductions correspond to equal tensile strengths. It ought therefore be possible on basis of this correspondence between reduction of cross section in drawing, and the tensile strength attained, to determine in advance what dimension of rod the drawing should be begun with in order to produce a finished wire of certain tensile strength and final diameter[5]. In a special section below there will be given a more detailed account of how the manufacturer can easily and simply determine this process.

2. Bending Test

In Figs. 2 to 4 are given the results of flexure tests with varying diameters. The shape of curves (a) and (b), (the usual test, constant radius) is similar, in general, to that of the tensile curves. Here also one can find in the first drafts a rise of flexion-test number proportional to increase in working, whereas with greater reductions the numbers increase more rapidly. This rise in flexion-test numbers can be noticed even in cases where the reductions lead one to suppose that the wire is overdrawn. From these curves one can easily see the influence of different rates of reductions on the bending test number. Despite the small difference between the test numbers corresponding to the heavier and lighter drafts the advantage of drawing with small reductions is noticeable. Throughout, the test numbers

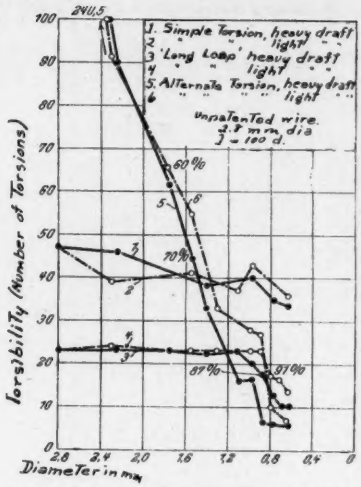


Fig. 7—Steel A. Change in torsibility due to cold working.

show higher values than in the curves for greater reductions. This fact confirms the conclusion that the quality of the wire is the better the lighter the drafts, that is, the lighter the reductions from draft to draft.

Curves 1c and 2c represent the flexion test numbers of wires bent over radius of r=2d. The curves of all wires show the same shape; the flexion number remains almost constant with increasing reductions in diameter. Those deviations which we meet in some cases of wires of very small diameter must be attributed to small inaccuracies in determining the flexure radius or the flexure leverage. The flexion numbers of individual rolls are to a slight degree dependent on the diameter of wire at which it is patented. With decreasing diameter of the wire, there is also a very slight rise in flexion strength which can be traced to the same causes as in tensile strength. It is striking that the flexion test number remains constant in every case despite

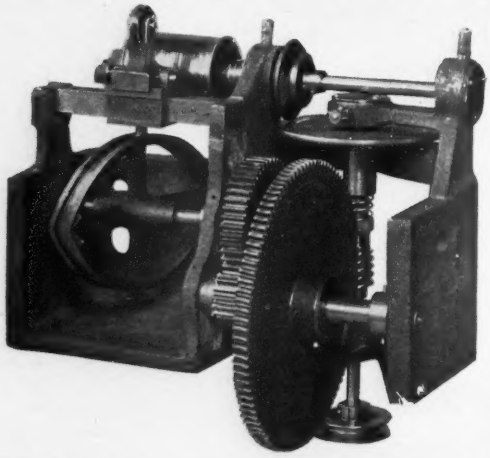
Table 3—Relation between size of reductions and tensile strength.

Härtedraht		Querschnittsabnahme											
		30 %		40 %		50 %		60 %		70 %		80 %	
mm Ø	kg/mm²	mm Ø	kg/mm²	mm Ø	kg/mm²	mm Ø	kg/mm²	mm Ø	kg/mm²	mm Ø	kg/mm²	mm Ø	kg/mm²
4,8	102	4,0	120	3,66	125	3,4	131	3,00	140	2,6	149	2,14	165
4,4	103	3,68	122	3,4	128	3,1	134	2,8	142	2,4	151	1,96	172
4,0	107	3,35	122	3,1	127	2,83	133	2,53	142	2,2	151	1,78	169
3,6	106	3,0	121	2,8	126	2,55	131	2,28	137	1,95	149	1,6	163
3,2	109	2,68	125	2,48	130	2,26	136	2,03	143	1,75	153	1,43	171
2,8	109	2,34	125	2,17	130	1,97	138	1,79	146	1,56	154	1,25	172

HARTEDRAHT, unpatented wire; QUERSCHNITTSABNAHME, reduction in cross section.

Spooling Attachment

Spools wire from .018 to .003 Dimensions 12″x12″x15″
Weight Approximately 50 lbs. Ball bearing equipped



The above illustration shows an open view of our No. 1 Spooler. All gears are enclosed.

Uniform tension and lay of the wire on the Spool is assured by the use of a screw cam. It is inexpensive, simple to operate and can quickly be attached to any machine.

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the fact that the wire has been drawn to the extreme limit of its flexibility. If then the flexure number shows no decrease, we must conclude that the flexure test cannot serve as the sole means for the judging of a wire in addition to the fracture test. Further, there is the uncertainty in carrying out the flexure test. Outside of the fact that with different construction of the flexure apparatus we will always obtain different flexion numbers, whose difference, particularly in cases of diameter below 2mm. will be quite large, the carrying out of the test plays a part which must not be underestimated [speed of test, uniform not jarring bends in the extreme positions, the setting of the wires[6]]

3. Torsions

Figs. 5 to 7 contain the results both of simple torsion tests and of alternate torsion and of "long loop" tests.

a) Simple Torsion test—In general, one can say that torsion number decreases gradually with increase in reduction of cross section but in such small degree that with the greatest reduction, you can scarcely notice any decrease in torsibility.

The favorable influence of drawing with light drafts does not appear in the same degree in this test as in the flexure test, nevertheless here, too, there can be noticed an increase in torsion number through use of smaller reductions.

As the torsion test has been carried out hitherto, it gives no absolutely certain standard of judging the quality of the wire.

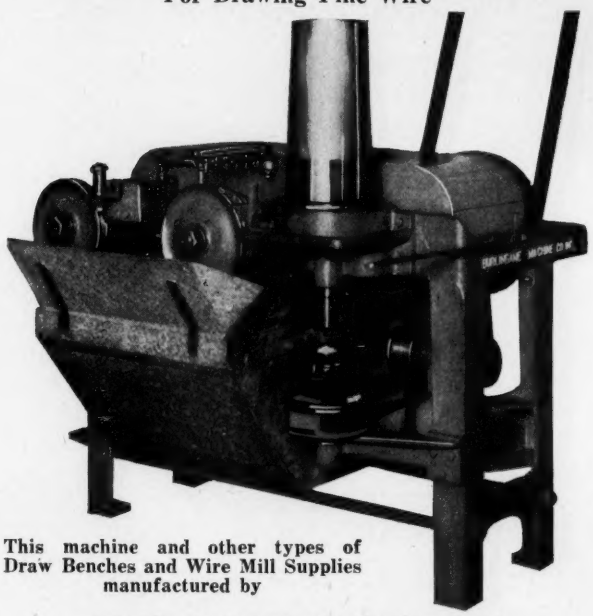
b) "Long loop"—The torsion numbers of wires drawn with light draft (cf. Figs. 5 to 7) are higher in all wires investigated than in the cases of wires drawn with heavier drafts. The curves for both methods of drawing at first flow quite horizontally but then suddenly fall very low. If one compares the extent to which the wire has been worked, then it appears that this fall in the torsion curve in wires drawn with strong drafts, is between 86 and 90% of total cross

section reduction and in rolls drawn with light drafts it is between 89 and 93%. The tensile strength corresponding to both these points is the same in all wires, since all inflection points of the same drawing process show the same degree of cross section reduction. The significance of this inflection point will be discussed further.

c) Alternate torsion—The following results show that the alternate torsion resistance decreases considerably with increasing reductions. Further, it can be proved that the alternate resistance of the wire is with equal final dimensions the higher, the smaller the reduction from draft to draft, and the larger the number of drafts in obtaining the desired diameter.

The repeated stress resistance of the wire increases with decreases in diameter. Thus, the fresh drawn wire of 4.6 mm. dia. shows a repeated stress of 76 alternate torsions, the wire of 3.6 mm. patented shows 132, and a wire of 2.8 mm. patented shows 240 torsion. As the curves further show that in cases of patented wire of small diameter the decrease in alternate-torsion-test number from draft to draft is much larger than in cases of freshly drawn wire of greater diameter. As the illustrated instances show the numbers for the repeated stress are higher for wires of smaller diameter which were drawn from wire rod of small diameters; the per cent reduction and therefore the final strength remaining equal. In the graphs those points have been plotted which correspond in wires drawn on heavy drafts to a reduction of 70%, and in wires drawn on light drafts to reductions 60%. In finished wire of 1.5 mm. diameter drawn from rod of 2.8 mm. with reduction of 70% the torsion number amounts to 44, whereas wires of 2.55 mm. drawn from rod of 4.6 mm. with equal reduction show only 2.4 torsion. The alternate torsion is therefore strongly dependent on the dimensions of the original cross

Continuous Wire Drawing Machine
6 Draft Liquor Finish
For Drawing Fine Wire



This machine and other types of Draw Benches and Wire Mill Supplies manufactured by

BURLINGAME MACHINE CO.
149 COMMERCIAL ST., WORCESTER, MASS.

ROTARY WIRE STRAIGHTENING AND CUTTING MACHINES

FULL AUTOMATIC

Equipped with flying shear allowing uninterrupted feed of wire through the machine.

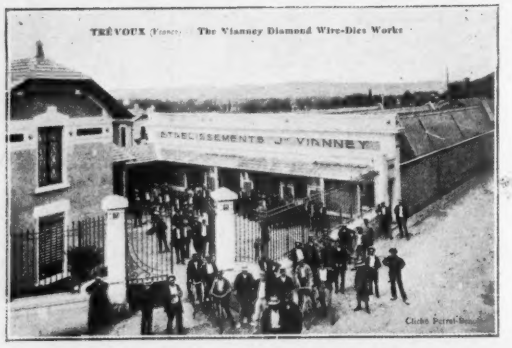
Guaranteed not to mark or swell wire in spots.

Write for Bulletin

HALLDEN MACHINE CO.
Thomaston, Conn.

VIANNEY WIRE DIE WORKS

100 FIFTH AVE., NEW YORK



Factories
—
Trevoux
Vezeronce
New York

1314
Drills
in
Operation

OUR PLANT AT TREVOUX (FRANCE)

OLDEST AND LARGEST
DIAMOND DIE
MAKERS

Save ACID and TIME in pickling

YOU can save pickling time by FIRST cleaning your wire with OAKITE materials. OAKITE removes all grease, oil and dirt. Leaves the wire clean. And thus enables the pickling acid to do its own work better and quicker.

Not only is less time required for pickling, but less acid, too, is used up, and frequently the wire is improved.

OAKITE materials can also be used for neutralizing an acid condition on work after pickling, OAKITE does it thoroughly and at low cost.

Talk over your cleaning with one of our service men. He will tell you how you can save money with OAKITE methods. Write us. No obligation.

Oakite Service Men, cleaning specialists, are located in all the leading industrial centers of the United States and Canada

Oakite is manufactured only by
OAKITE PRODUCTS INC., 52A Thames St., NEW YORK, N. Y
(Formerly OAKLEY CHEMICAL CO.)

OAKITE
TRADE MARK REG. U.S. PAT. OFF.
Industrial Cleaning Materials and Methods

section at which the patenting takes place, and indeed is the higher the smaller the diameter of the unpatented wire chosen. The higher torsion numbers of unpatented wire of smaller dia. are apparently a result of the better tempering which occurs in case of thin wire more uniformly and thoroughly, than with larger diameters. The improvement of wire quality through use of light draft is also to be taken into consideration with respect to torsions. The alternate torsion numbers seem to approach a limit, constant for all cases under extreme cold-working.

---

2. Altpeter, Stahl u. Eisen, v. 45 (1925) page 569 ff.

3. Ferrum, vol. 10, (1912-13) page 65.

4. Stahl und Eisen, vol. 44 (1924) page 1687.

5. E. Siebel, E. Houdremont, und A. Kallen, Ber. Werkstoffausch, V. d. Eisenh, No. 71 (1925).

6. Gluckauf vol. 60 (1924) page 1111-20.

(The next installment of this series of articles will appear in the June issue.)

Some Investigations On the Properties Of Rope Wire

(Continued from page 153)

Assuming then that the above arguments have justified the use of wire in the cold drawn condition for wire ropes in spite of the low fatigue limit, the problem of the amount of cold working which should be applied to the wire on the draw-bench remains, bearing in mind that it is possible to get wire with a tenacity of about 90 tons per square inch in a purely heat treated condition. In order to investigate this problem the writer is at present engaged in a research into the properties of wire at each stage in drawing, the properties under investigation being fatigue limit and endurance under higher stresses, resistance to reverse bending, torsions, ductility as represent-

(Continued on page 177)

Domestic Exports of Iron and Steel Wire, Wire Rope and Wire Nails, From the United States, By Countries

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Belgium	.....	.....	.....	.....	14	.....
Greece	.....	.....	.....	3,818	1,896	.....
Italy	510	316	.....	335	.....	1,520
Malta, Gozo, & Cyprus	270	.....	.....	.....	.....	.....
Norway	15	13,250	.....	22,187	.....	.....
Spain	.....	4,017	.....	.....	.....	.....
Sweden	900	.....	.....	.....	.....	.....
Switzerland	500	.....	.....	.....	.....	.....
United Kingdom	12,343	13,416	.....	140	.....	17,589
Canada	699,019	2,185,855	526,946	35,081	6 070	9,068
British Hond.	.....	395	2,625	2,166	.....	1,642
Costa Rica	800	.....	44 600	4,808	714	13.803
Guatemala	700	400	37,000	1,540	.....	14,200
Honduras	968	.....	50,152	3,525	.....	24,621
Nicaragua	1,061	.....	71,983	3,631	.....	14,564
Panama	.....	.....	47,950	14,048	2,814	18 421
Salvador	.....	.....	.....	.....	1,132	25,359
Mexico	277,189	67,592	769,935	146,207	7,987	71,781
Newfoundland & Labr.	1,912	.....	.....	1,639	.....	2,500
Bermuda	.....	1,040	.....	1,118	365	.....
Jamaica	.....	631	43,370	4,530	.....	50
Trinidad & Tobago	.....	.....	.....	4,840	1,847	600
Other Brit. West In.	400	.....	810	650	.....	33,215
Cuba	151 548	145,684	283.000	64,569	1,058	234,596
Dominican Repub.	8,324	4,653	103,970	710	470	12,600
Dutch West Ind.	.....	.....	.....	2,748	418	600
Haitian Republic	.....	397	5,000	455	.....	6,700
Virgin Is. of U. S.	.....	.....	700	153	417	1,100
Argentina	250	34,711	.....	11,919	.....	270
Brazil	11,090	11,271	401,283	7,340	.....	1,608
Chile	3,420	200 254	.....	.....	.....	1,842
Colombia	73,831	1,740	903,995	92,677	8,222	242,395
Ecuador	.....	.....	36,000	.....	1,273	.....
Peru	12.405	63,680	38,000	3,584	.....	98,491
Uruguay	.....	.....	.....	160	.....	.....
Venezuela	1,669	15,172	196,267	14,531	.....	28,351
British India	.....	.....	.....	13,470	.....	.....
British Malaya	.....	.....	.....	12,293	6,863	.....
China	82,400	78,254	.....	.....	.....	.....
Java & Madura	25,716	.....	49 604	40,372	.....	4,605
Other Dutch East In.	.....	.....	277,028	.....	.....	.....
Hongkong	.....	115,100	.....	.....	.....	.....
Japan, inc. Chos.	176,550	72,800	.....	25,252	.....	.....
Persia	.....	.....	.....	102,378	.....	.....
Philippine Is.	25,181	48,450	.....	115,233	10,299	17,200
Australia	306,352	53,598	45,950	.....	2 802	.....
British Oceania	.....	.....	.....	.....	.....	2,028
French Oceania	.....	200	1,058	80	.....	2,548
New Zealand	260	.....	.....	.....	.....	1,644
Belgian Congo	.....	.....	.....	138	.....	.....
Brit. South Afr.	.....	.....	236,400	.....	.....	.....
Brit. West Afr.	.....	700	.....	.....	.....	432
Egypt	5,700	.....	.....	.....	.....	.....
Algeria & Tunisia	.....	.....	.....	156	.....	.....
Portuguese East Afr.	.....	.....	202,000	.....	.....	.....
Total Quant.	1,881,283	3,133,576	4,375,626	758,481	54,667	905,943
Total Values	87,482	112,670	149,852	98.568	10 718	40,251

Shipments from the United States to Non-Contiguous Territories

Alaska	.....	310,067	30,418	135,191	5,672
Hawaii	.....	381,097	38,336	173,293	9.766
Porto Rico	.....	253,014	16,695	56,640	2,513

Domestic Exports of Iron and Steel Wire Manufactures, Horseshoe Nails, From the United States, By Countries

Countries	Woven wire fencing	Wire cloth and screening	Wire not elsewhere specified,	Horseshoe nails	Horseshoes
	Pounds	Pounds	Dollars	Pounds	Pounds	Pounds
Belgium	.....	.....	.....	561	19,910	.....
Finland	.....	.....	.....	1,453	.....	.....
France	.....	.....	.....	125	.....	.....
Germany	.....	.....	.....	332	.....	.....
Italy	.....	.....	.....	4,350	22,000	.....
Netherlands	1,710	.....	.....	93	4,620	.....
Norway	.....	.....	.....	1,706	.....	.....
Portugal	.....	1,020	180	.....	.....	.....
Spain	.....	.....	.....	204	.....	.....
Sweden	164	.....	.....	1,263	.....	.....
Switzerland	.....	.....	.....	323	4,400	.....
United Kingdom	55,412	.....	.....	119,235	.....	.....

RIEHLE

Back in 1866 while we were still in the scale business, S. Fulton and Co., manufacturers of cast iron pipe, were having trouble with rejections of their product. Mr. Fulton suggested that they

WRITE RIEHLE

and ask us to solve their problem. Thus we designed and made the first Testing Machine. It was crude but served the purpose, and after that the engineering profession continued to

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to solve their testing problems, until now we make over a thousand different machines and appliances to meet the countless needs of the physical testing field. If you are contemplating purchasing a Testing Machine, or desire catalogues and information

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and know that we will give the same satisfactory service to you as we did back in 1866 to S. Fulton and Company.

Riehle Bros. Testing Machine Co.

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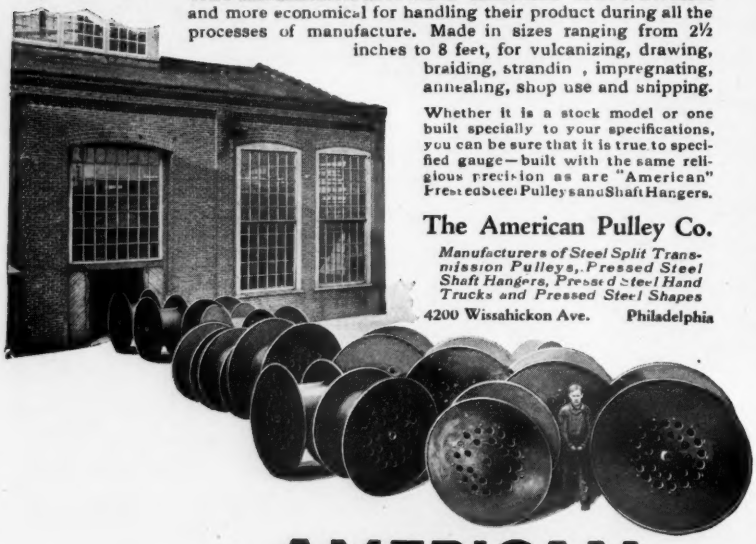
Philadelphia, Pa.

TESTING MACHINES

Pressed Steel Reels that Come Back for More!

TONS of fractious, unwieldy cable require "American" Pressed Steel Reels. Practically indestructible and stronger. Wire manufacturers have found "Americans" more convenient and more economical for handling their product during all the processes of manufacture. Made in sizes ranging from 2½ inches to 8 feet, for vulcanizing, drawing, braiding, strandin , impregnating, annealing, shop use and shipping.

Whether it is a stock model or one built specially to your specifications, you can be sure that it is true to specified gauge—built with the same religious precision as are "American" Pressed Steel Pulleys and Shaft Hangers.



The American Pulley Co.

Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shaft Hangers, Pressed Steel Hand Trucks and Pressed Steel Shapes

4200 Wissahickon Ave. Philadelphia

AMERICAN PRESSED STEEL REELS

Canada	127,561	46,617	9,093	426,239	118	1,492
British Honduras	360	1,024	177	27	.....	.....
Costa Rica	228	214	89	168	300	10,000
Guatemala	1,020	241	36	29,259	1,000	.....
Honduras	254	722	87	1,881	.....	.....
Nicaragua	760	170	118	.....	.....	.....
Panama	685	8,483	698	7,200	825	2,700
Salvador	.....	.....	.....	2,688	.....	.....
Mexico	30,290	15,734	3,854	67,438	11,196	13,782
Newfoundland & Labr.	.....	.....	.....	265	.....	.....
Bermuda	100	299	65	1,379	100	1,300
Jamaica	4,534	540	81	1,808	.....	.....
Trinidad & Tobago	127	889	89	1,339	.....	1,200
Other Brit. West In.	.....	2,849	456	201	.....	.....
Cuba	138,772	30,813	3,544	78,164	22,675	1,800
Dominican Repub.	719	2,294	241	8,018	.....	.....
Dutch West Indies	.....	1,500	180	455	.....	.....
Haitian Republic	.....	421	58	20,752	.....	.....
Argentina	.....	.....	.....	4,042	.....	.....
Brazil	.....	.....	.....	390	.....	.....
Brazil	1,448	1,810	238	9,675	252	.....
Chile	1 290	6,198	1,085	17,357	500	.....
Colombia	.....	11,918	1,526	21,950	11,923	.....
Ecuador	.....	4,324	845	397	.....	.....
Peru	13,187	3,781	309	71,264	2,150	.....
Uruguay	.....	175	30	215	.....	.....
Venezuela	7,124	5,155	814	3,813	.....	.....
Arabia & Hejaz	.....	22,864	3,843	.....	.....	.....
British India	72,727	5,909	1,137	166,120	.....	.....
British Malaya	2,744	.....	.....	.....	.....	.....
China	.....	41,958	7,553	135,674	1,750	.....
Java & Madura	1,717	9,949	1,647	400	.....	.....
Other Dutch East In.	30,773	.....	.....	.....	.....	.....
Hongkong	.....	40	19	.....	.....	.....
Iraq	.....	.....	.....	1,816	.....	.....
Japan, inc. Chos.	.....	6,396	1,168	120,973	.....	.....
Kwangtung	.....	45 293	8,050	.....	.....	.....
Philippine Is.	26,987	9,528	1,543	42,601	42,800	.....
Syria	.....	170	43	.....	.....	.....
Australia	.....	9,770	1,630	90,666	8,387	1,344
British Oceania	.....	110	24	15	.....	.....
French Oceania	.....	600	160	200	50	.....
New Zealand	.....	1,177	215	6,893	7,722	.....
British East Afr.	.....	35	10	.....	.....	.....
Brit. South Afi.	.....	15,470	2,817	4,821	250	.....
Algeria &Tunisia	.....	88	10	.....	.....	.....
Liberia	1,355	.....	.....	44	.....	.....
Portuguese East Afr.	.....	3,507	690	.....	.....	.....
Total Quant.	522,028	31,567	.....	1 476,252	162,928	33,618
Total Values	31,567	.....	54,452	140,328	16,830	2,811

NEWS of the INDUSTRY

Exhibition of Fence Machinery in New York City

OWING to the increased demand for chain link fence, machinery manufacturers have always been on the lookout for methods of increasing the output from existing machinery.

The original inventor of the automatic machine for making chain link fence claims that he has at last, after 11years of research and experimentation hit on the right idea practically to double the output of his machine. by inventing a double spiral machine, that is, one which feeds two wires into the machine in place of one wire as heretofore.

For smaller wire gage, such a machine was shown in New York a few months ago and a machine to weave from 2" to 5" mesh in wire gages from No. 6 to No. 11 will be shown shortly. This, no doubt, will be of great interest to fence makers.

A great improvement on this machine is the newly invented combination spiral winding tool that eliminates the influence of the varying temper of the wire and allows adjustment of each wire separately. The standard working widths of this loom are 10 and 12 feet, which meet the requirements of today's market. It is also interesting that on this machine one can barb or knuckle the ends on both sides; or on one side only—either top or bottom—as desired. Also the weave can be made flat or round.

BELDEN Mfg. Co., 2300 South Western Ave., Chicago, manufacturer of cables, insulated wire, etc., plans to remove its Chicago plant to Richmond, Ind. The contract for the first unit of its new plant at Richmond has been let to John Mueller, Richmond, Ind. The structure is scheduled for completion about Oct. 1, and will cost about $200,000. Two additional units will be built later.

WINSTEAD has a new enamelled wire industry, the Sweet Manufacturing Company having been formed with a capital stock of $50,000. It will manufacture enamelled wire under a new formula discovered by Mr. Sweet. The management expects to begin production in about two weeks.

From Boston Transcript, Apr. 11, 1927.

THE Safety Cable Co., 114 Liberty Street, New York, manufacturer of electric wires and cables, etc., has purchased the plants and businesses of the American Insulated Wire & Cable Co., 954 West Twenty-first Street, and the Brenner-Moxley-Mervis Co., 3427 South Kedzie Ave., both of Chicago, and will consolidate with its organization. The American Insulated Wire & Cable Co. specializes in the manufacture of insulated and bare copper wire, and magnet wire; the Brenner-Moxley-Mervis Co. manufactures copper rods, wire, etc., and it is understood that these two plants will be continued in service. Several months ago, the Safety Cable Co. merged with the Safety Insulated Wire & Cable Co., New York, the Phillips Wire Co., Pawtucket, R. I., and the A-A Wire Co., Harrison, N. J.

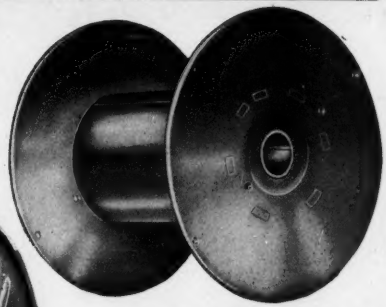
THE Albion Metal Products Co., 310 Washington Street, Albion, Mich., is planning the manufacture of a patented insect and dust screen for use on automobiles. The company is in the market for cold-rolled strip steel, 30-mesh copper wire cloth and special steel shapes.

THE Globe Wire & Iron Works, manufacturers of a large variety of wire products at 1007-1023 Atkinson Ave., Milwaukee, has increased its capitalization from $100,000 to $150,000 in contemplation of further extension of plant and equipment.

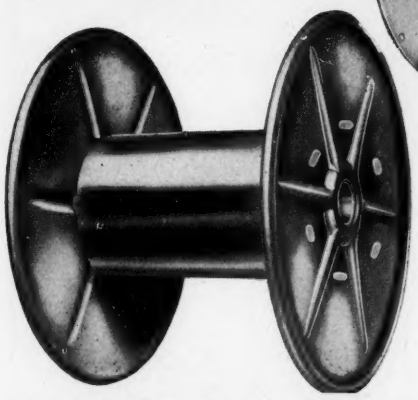
WISCONSIN Iron & Wire Works, 1660 Booth Street, Milwaukee, is planning the construction of second-story additions to the pattern shop, 40x60 ft., the drafting room, 40 ft. sq. and the office building, 40x60 ft. The equipment and machinery will cost about $35,000.

A WIRE rope manufacturing plant to be located at Vancouver, B. C., is planned by the Western Hardware & Metal Co., Ltd., Winnipeg. About 50 men will be employed at the proposed plant.

Specializing in the Manufacturing of REELS & SPOOLS of all sizes.



For Annealing and Handling Fine Wire



Spool for Handling and Shipping Wire. (Patented)

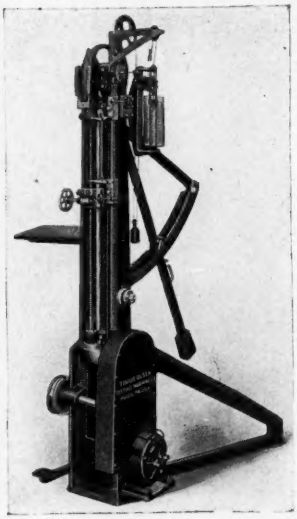
We solicit your inquiries

Mossberg Pressed Steel Corporation

81 WEST ST., ATTLEBORO, MASS.
2051 Grand Central Terminal, NEW YORK CITY
Russell A. Singleton, 713 Slaughter Bldg., DALLAS, TEX.
140 S Dearborn St., CHICAGO, ILL.
101 Augusta St., GREENVILLE, S. C.

Olsen Vertical Autographic Pendulum Type
WIRE TESTER

Made in capacities from 50 lbs. to 1000 lbs.



This illustration is of the very latest up-to-date Autographic Wire Tester which will scribe the stress strain diagram on square cross-section paper, correcting for the sine angle of the pendulum to magnify the elongation of the wire ten times. The autographic record may be taken directly from the wire, and thus the greatest of accuracy secured in such a record, as we do not consider any autographic record or wire test as satisfactory or acceptable taken from the motion of the heads of the testing machine.

Olsen Autographic Wire Testers can also be secured of capacities from 10,000 lbs. up to 1,000,000 lbs. capacity for testing steel, copper or brass wire of all gauges, as well as the largest wire rope made.

Also manufacturers of Olsen Static-Dynamic Balancing Machine equipment for balancing high speed rotating parts, which will eliminate vibration and increase efficiency and production of all high speed machinery.

Manufactured by

TINIUS OLSEN TESTING MACHINE CO.
500 North 12th St., Philadelphia, Pa.

Metal Spools For Wire Drawing

Metal Spools for Annealing

Metal Lined Spools for Shipping

Metal Lined Reels for Shipping

Hubbard Spool Co.

1622 Carroll Avenue

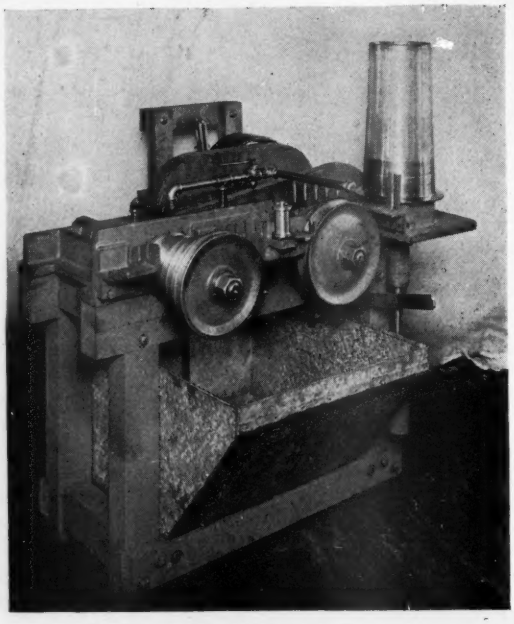
Chicago

The "Superior" Wire Drawing Machine

The ultimate in a compact and inexpensive machine.

One man efficiently operates 6 of these machines simultaneously.

6-Draft Type
Floor Space 39"x54"
Capacity .032" to .004"



Designed and Manufactured by

The Superior Tool & Mfg. Co.

172 UNION ST. WORCESTER, MASS.

Designers and Builders of Wire Drawing and Special Machinery

UNITED Wire & Supply Co., 1497 Elmwood Ave., Auurn, R. I., has incorporated as the United Wire & Supply Corporation. The firm will continue the same line of products as before.

ACME Iron & Wire Works, 1929 St. Paul Ave., Milwaukee, has been organized by A. C. and M. C. Klinka, formerly with the Banner Iron & Wire Works. The new firm will specialize in architectural wire work, iron work, etc.

THE Coles Automobile Mud Chain Co., Inc., of Camden, Tenn., is planning a one-story factory to be devoted to the manufacture of automobile skid chains.

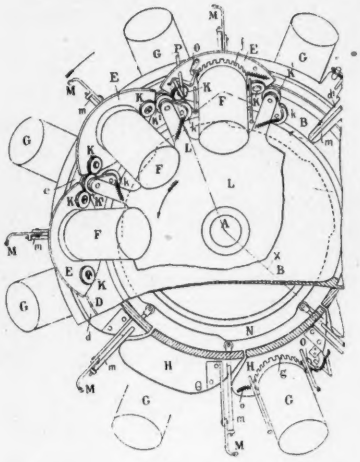
WIRE Wheel Corporation of America, 1700 Elmwood Avenue, Buffalo, has made final arrangements for the purchase of the American Car & Foundry Motors Co., an auxiliary of the American Car & Foundry Co., 30 Church St., New York, manufacturing wire wheels. The plant is in Detroit. The Wire Wheel Corporation will continue the operation of the Detroit plant for the production of the Ash wire wheel for automobiles which was invented by C. S. Ash, who is to become the consulting engineer of the Corporation. He is now planning to transfer a part of the equipment to the plant at Buffalo which is to become the main plant. A company, newly chartered under New York laws, and similarly known as the Wire Wheel Corporation of America, Inc., will take charge of the operation of the enlarged organization. The captital stock of 74,000 shares of stock, having no par value. The President of the Corporation is Mr. H. G. Jackson.

ROME Wire Co., Rome, N. Y. will soon begin work on the superstructure of its one story mill addition on Amherst St., Buffalo. Floor space 120x300 ft. cost over $100,000.

Review of Recent Patents

Conducted by
Eugene Grunstein

Braiding Machine



A braiding machine of English design, with some novel features.

U. S. Patent 1,610,054, issued to Alfred Hopkinson, Hyde, England.

Wire Drawing Machine

THIS invention relates to wire drawing machines of the type in which the wire operated upon is reduced in diameter a number of times by being successively passed through a series of dies in one continuous drawing process.

In machines of this kind positively rotated drums are provided for drawing the wire through the dies. Since the drums are rotated at fixed speeds relatively to each other variations in the speed of travel of the wire produces slippage of the latter over the surface of the winding drums. This slippage produces disadvantageous results since not only is the wear on the drum considerable but also the coating of the wire is injured, thereby making it difficult to produce good wire.

A further trouble often experienced with wire drawing

ROBERTSON'S SOAPS

MANUFACTURERS OF WIRE DRAWING SOAPS
SINCE 1895

THE J. T. ROBERTSON CO., Inc.
Syracuse, N. Y.

CABLE ADDRESS, ROBECO. 147 RICHMOND AVE.

F. KRAUSE DIAMOND DIES

All sizes, immediate deliveries.
Dies for High Speed Wire Drawing Machines guaranteed.
F. KRAUSE & CO., Inc.
Jersey City, N. J.
Phone: Webster 5105 250 OGDEN AVE.

NEW YORK GENEVA
DIAMOND DIE COMPANY of AMERICA
Manufacturers of Steel Set Diamond Draw Plates
For drawing all kinds of wire
Recutting
Repolishing
Repairing
Prompt shipments
"STEELITE SET"
421 Seventh Ave., Opposite Penn Station
New York City Phone, Penn. 4226

The Patented Diamond Die
of proven superiority
through practice and not theory.
The standard of leading wire mills.
Manufactured by:
UNION WIRE DIE CORP.
250 W. 40th St., New York City

W. E. Sommerville
Designers and Manufacturers of highest grade
Stranding Machines—High Speed and Planetary
Spooling and Winding Machines
Closing Machines
Continuous Wire Drawing Machines
Designers of Special Machinery
Coal City, Illinois

6-UNIT LAYER-WINDING SPOOLER

SINGLE UNITS OR IN GANGS

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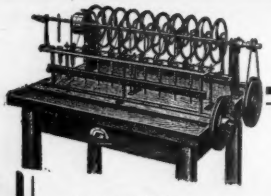

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U. S. Patents
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1039186—1912
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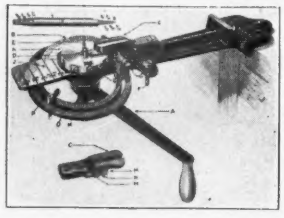


Patented April 2, 1918

M. D. Kilmer & Co. Cleveland, Ohio, U. S. A. Box 237, Station B.

machines is that the wire as first formed is not perfectly cylindrical and may have a feather along one side. If such a wire is drawn through a die it tends to cut grooves in the die.

One of the principal objects, therefore, of the present invention is to provide means for varying the speed of the drums in accordance with the tension in the wire to avoid such slippage.

An important object of the invention is to rotate the wire as it passes through the die to equalize the wear on the latter and produce a more uniform and satisfactory product.

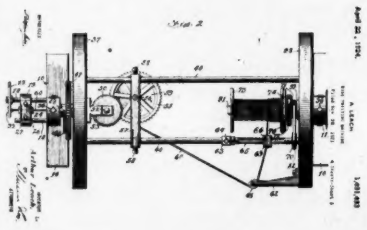
The invention is to provide means for preventing irregular jerky movements of the drums due to back-lash in the driving connections therefor or other causes.

Means are provided for stopping the machine should the wire break, become tangled or for other reasons.

An additional object of the invention is to provide threading means which may be driven when the rest of the machine including the drawing drums is stationary so as to prevent the drums from rubbing the wire when the latter is drawn through the dies for winding around the drum and incidentally protecting the men from injury, which is not possible should the drums be in constant rotation.

U. S. Patent 1,491,483, issued to John W. Lauren, Chicago, Ill., assignor to Sterling Wire Machinery Co., Sterling, Ill.

Stranding Machine



The invention aims to eliminate the operation of winding or spinning the material.

U. S. Patent 1,601,124, issued to A. Leach, Kenosha, Wis.

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Some Investigations On the Properties of Rope Wire

(*Continued from page 170*)

ed by elongation and tenacity. The results of this investigation he hopes to publish at some future date, but it may be of interest to summarize here the results of his bending tests, since these seem to have a direct bearing on the endurance of the wire. In order to make these tests comparative on different samples, wire of one size only, namely number 15 Standard Wire Gauge or 0.071″ diameter was used and results of the bend tests on two different carbon steels are tabulated below. From these it will be seen that within certain limits the amount of drawing does not appreciably affect the reverse bend tests and, therefore, presumably, though this needs confirmation, does not seriously affect the life of the wire under alternate stresses beyond the fatigue limit.

Much work remains to be done before these investigations can be fully confirmed and the final stage of the work should consist of actual wire rope tests but, from what has been done so far, it would seem that a rational scientific explanation can be given to support the best present day practice in the production of rope wire.

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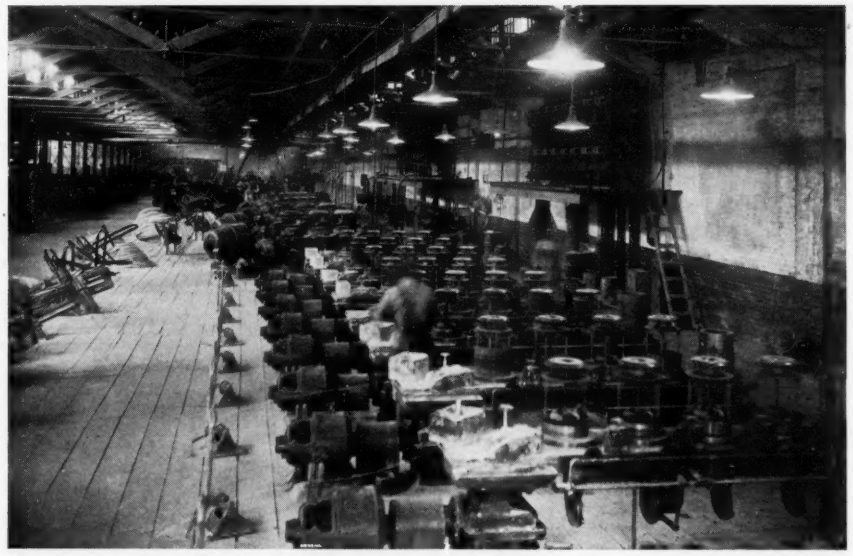

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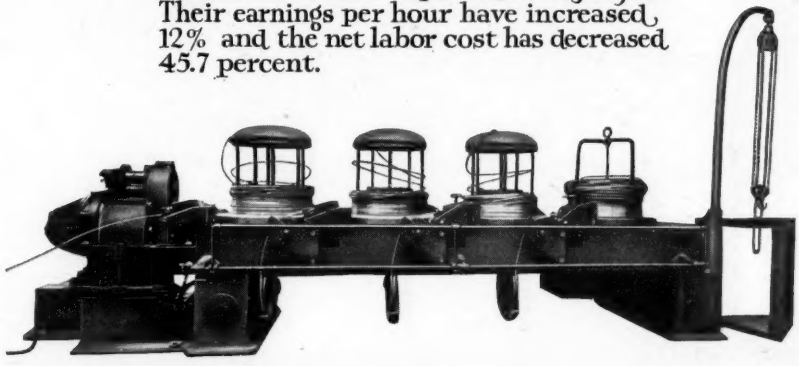

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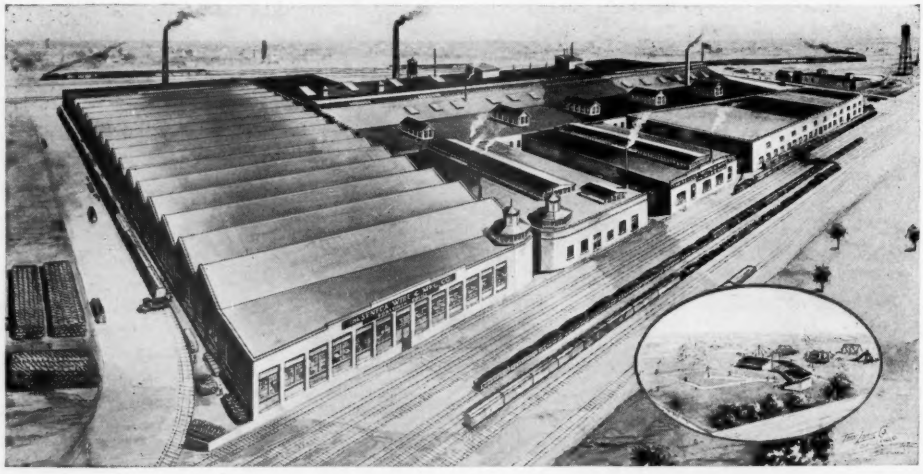

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